[Canada]

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Ontario

Federal-Provincial Conference of First Ministers on Energy

Ottawa January 22 & 23, 1974

Ontario Background Papers

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contents

petroleum

Highlights

. At present Canada has the capacity for self-sufficiency in petroleum production but lacks the transportation network to move the crude oil to all parts of the country, i.e., Montreal and Eastern Canada are supplied with foreign crude oil.

. Canada currently exports about 1 million barrels per day from Western Canada and imports about 800,000 barrels per day into the Eastern Provinces, i.e. Canada is a net exporter of crude oil to the extent of 200,000 barrels per day.

. On the basis of present known reserves of conventional crude oil, Canada could not therefore supply total Canadian petroleum requirements without severely cutting exports to the United States.

. Western Canadian production of crude oil is expected to peak in 1977 at about 1.97 MM B/D (0.200 MM B/D of synthetic crude and pentanes derived from natural gas increase the peak to 2.2 MM B/D).

. By 1979, Canada would barely be able to supply its own requirements (2.0 to 2.5 MM bbls/day) let alone export to the U.S.

. Starting in 1980, Canada will need to add production capacity of about 175,000 barrels per day per year to meet projected Canadian requirements. It is generally agreed that this will have to be provided from extra synthetic plants or frontier areas.

. Constructing one synthetic oil plant each year at a cost of about $1 billion would add 125,000 B/D to annual capacity. There would be major problems of manpower availability and supplies of construction materials and even then, adding one plant each year would not be sufficient to meet total Canadian requirements.

. Oil has not yet been found in sufficient quantities in the Arctic regions of Canada to justify a pipeline. It seems unlikely that oil will be removed from the Arctic before 1985.

. Accordingly, Canada is probably looking at a shortfall in self-sufficiency for the period of about 1978 through at least to 1985, or later if Arctic and Eastern off-shore reserves or transportation links cannot be developed.

Petroleum Supply/Demand 1973-2000

. Estimates of total Canadian supplies of conventional crude oil and synthetic crude oil are presented in Table 1 (attached). Estimates of total Canadian demand, derived from "An Energy Policy for Canada", are the conservative estimates of demand and do not take account of changes in relative prices between alternate sources of energy and energy prices relative to other prices.

. For Canada to be totally self-sufficient in oil beyond 1980, major oil sands development will have to be undertaken and/or new reserves located and developed. (See Chart 1).

. The present disposition of Western Canadian crude oil is presented in Table 2 (attached). Table 3 (attached) provides information of Canadian imports of oil by province.

. Reserves and Production of Conventional Crude Oil

Table 4

Gross Reserves	1973	2000	
Alberta	8,117	3,100	mm bbls
Rest of Canada	885	229	mm bbls
TOTAL	9,002	3,329	mm bbls

Table 5

Annual Production	1973	1977	1980	1990	2000
Alberta	490	620	505	252	162
Rest of Canada	115	98	71	36	20
TOTAL mm bbls	605	718	576	288	182
TOTAL mm bbls/day	1.66	1.97	1.58	0.79	0.50

Synthetic Crude and Pentanes Plus Production increase total availability by about 0.20 mm bbls/day.

Athabasca Oil Sands*

- Gross bitumen in place estimated to be about 900 billion barrels of which 27 billion is recoverable as synthetic crude oil by surface-mining methods.
- Another 225 billion barrels could be recovered by in-situ methods once developed.
- Cost of a 100,000 bbl/day plant is expected to be $950 million at completion of construction.
- At $6.00/barrel known proved reserves would allow a total of 15 - 100,000 b/day plants with a life of 50 years.

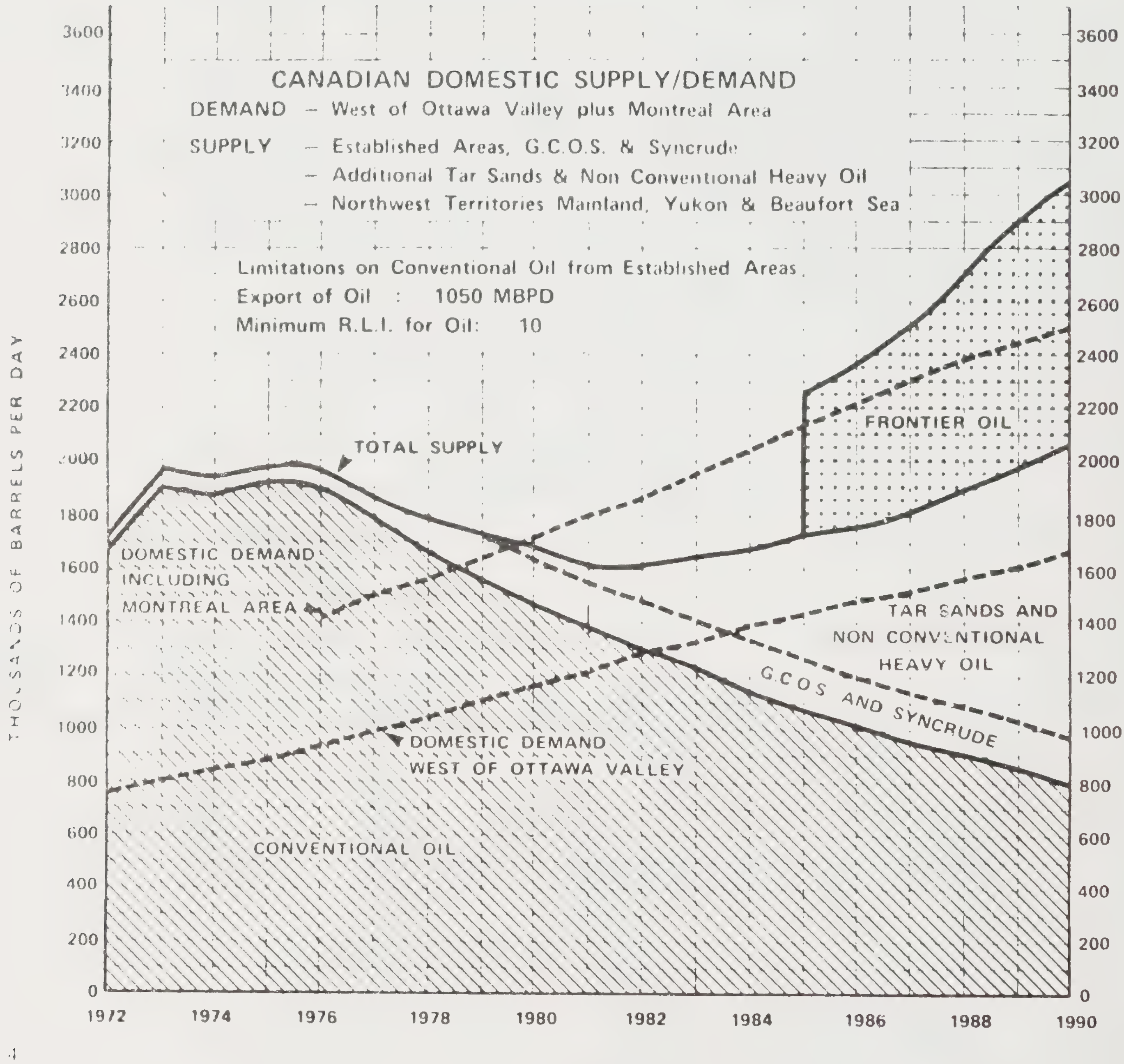
Revenues From Export Tax

DATE	BARRELS PER DAY	EXPORT TAX $/bl	REVENUES $M	CUMULATIVE REVENUE $M
Oct. '73	1,118,744	.40	13.9	13.9
Nov. '73	1,005,280	.40	12.1	25.9
Dec. '73	977,743	1.90	57.6	83.5
Jan. '74	975,670	2.20	66.5	150.1
Feb. '74		6.40		
March '74		6.40		

Source: N.E.B.

* Estimates were prepared by J. Strong, Consultant to The Government of Ontario (See Table 1, Note 1).

CHART 1



Source: Gulf Oil Submission to N.E.B. Jan. '74

Table 1

Petroleum Supply-Demand, Canada 1973-2000

- millions of barrels per day -

Year	Conventional Crude Oil and Pentanes Plus[1]	Synthetic Crude Oil		Total Supply		Total Demand[4]
		A2	B3	A	B	
1973	1.82	0.05	0.052	1.85	1.852	1.71
1974	1.93	0.05	0.055	1.98	1.985	1.78
1975	2.09	0.06	0.060	2.15	2.150	1.86
1976	2.14	0.06	0.065	2.20	2.205	1.94
1977	2.14	0.06	0.065	2.20	2.205	2.03
1978	2.06	0.06	0.115	2.12	2.175	2.12
1979	1.92	0.06	0.155	1.98	2.075	2.21
1980	1.75	0.06	0.220	1.81	1.970	2.31
1985	1.19	0.06	0.665	1.25	1.855	2.7
1990	0.89	0.06	1.265	0.95	2.155	3.2
2000	0.56	0.06	-	0.61	-	4.4

1 Source: J. Strong, consultant to the Government of Ontario, "Principles and Procedures for Determining the Available Supply of Oil and Current Best Estimates of the Trends in the Discovery of Oil," 1973.

2 Assuming no additional synthetic oil sands plants.

3 Estimates of Gulf Oil of Canada, Submission to the NEB, 1973.

4 Low Estimates of Demand from "An Energy Policy For Canada, Phase I, Government of Canada, 1973.

TABLE 2

Disposition of Western Canadian Crude Oil, March - November, 1973

---barrels per day---

Date	Authorized Crude Oil Exports to U.S.A.			Canadian Requirements Crude & Equivalent				
1973	(PAD I - IV)	(PAD V)	Total U. S. A.	Ontario	Quebec	Prairie Provinces	British Columbia	Total Canada
March	968,010	266,990	1,235,000	410,333	-	258,765	141,835	810,933
April	1,018,518	277,800	1,296,318	-	-	-	-	-
May	885,825	256,713	1,142,538	412,544	-	229,419	115,499	757,462
June	879,488	241,229	1,120,717	395,670	-	270,133	134,480	800,283
July	813,829	248,344	1,062,173	434,011	-	285,580	138,236	857,827
August	850,183	253,160	1,103,343	442,523	-	288,184	145,950	876,657
September	886,671	251,362	1,138,033	389,610	-	270,333	137,800	797,743
October	866,124	252,620	1,118,744	431,811	22,100	273,709	142,636	870,256
November	778,282	226,998	1,005,280	453,107	37,500	289,733	152,380	932,720

Source: NEB

TABLE 3

Crude Oil Imports - Canada
(In millions of barrels)

	1972		Jan.-Aug. 1973	
	Atlantic Province	Quebec	Atlantic Province	Quebec
Columbia	-	4.5	-	2.5
Iran	25.7	10.2	24.4	6.7
Iraq	-	6.1	-	4.1
Kuwait	0.9	-	-	-
Libya	0.3	12.0	-	10.0
Nigeria	-	21.3	-	13.4
Saudi-Arabia	20.6	6.4	11.7	7.2
Trinidad	-	1.3	-	-
Trucial States	-	17.2	-	20.3
Venezuela	33.1	108.9	25.6	70.1
Other	16.4	3.4	11.4	1.4
Imported Total	97.2	191.1	72.9 (Jan.-Aug. 1972) 66.4	135.8 (Jan.-Aug. 1972) 126.0

Source:- Statistics Canada, Refined Petroleum Products, Cat. 45-004 and 45-204

SUMMARY AND CONCLUSIONS

. Two basic policy issues can be identified:

- how to attain a capability for self-sufficiency in the long-run for petroleum resources.
- at what price should petroleum and petroleum products be brought to market both in the area served by Canadian crude oil and also in the area served by foreign crude oil.

. In view of the expected short-fall in Canadian supplies after 1979, self-sufficiency can be achieved in the long-run only by developing some combination of oil sands, heavy oil deposits and frontier deposits together with the necessary transportation network.

. To rely solely on oil sands development would involve an annual expenditure of $2 billion and potential success is still uncertain.

. Frontier areas, i.e., Arctic and Eastern Offshore, involve considerably more in exploration, drilling and transportation cost with technology still unproven in many ways.

. Additional investment must be encouraged in these programs either by incentives to the private sector or direct government action.

. Petroleum pricing is a complex issue and alternative pricing strategies must take into account:

- the desirability of a single Canadian price
- the relationship of Canadian prices to world (and U.S.) levels

- the rising cost of new sources of oil and the need to encourage exploration
- the impact of prices on demand for oil and its substitutes
- the implication of lower domestic prices for energy conservation measures and industrial development
- the distribution of sales and tax revenues to producers, governments and consumers

. In order to implement any pricing strategy effectively, a national marketing agency will be required, its duties depending upon the particular strategy adopted.

CAPABILITY FOR SELF-SUFFICIENCY

1. Background

. One of the two basic policy issues is - how to attain a capability for self-sufficiency in the long-run for petroleum resources. Self-sufficiency can be defined as having production capability equal to or greater than the domestic demand. It applies whether the crude oil is actually used directly in Canada or traded off against secure foreign supplies for areas where transportation advantages accrue from using non-domestic crude oil.

. Achievable only by developing Oil Sands, Cold Lake deposits, Frontier, (i.e, Arctic and Eastern Offshore) production or combination of these together with the necessary transportation network.

. Oil Sands

- known massive reserves, i.e., less risk,
- some experience in production through companies such as Great Canadian Oil Sands, Syncrude and proposed Shell program,
- present techniques only useful to a depth of about 150 feet or about 10% of known reserves,
- deeper reserves need processing "in situ",
- techniques for this are not yet developed, therefore the costs are unknown and potential success still uncertain,
- major problems will exist in getting enough people and equipment into the area in time,
- no new major transportation links are required.

. Cold Lake Deposits

- high potential known resources,
- requires new technology for recovery.

. Arctic and Eastern Offshore Areas

- high potential, but finds to date have been gas prone;
- drilling very expensive, but potential major discoveries would result in economic production;
- technology for transmission via pipeline, ship and rail still unproven;
- unlikely to be available before 1985.

2. Size of Investment Program

. Oil Sands

- $1 billion per year to produce an increment of 125,000 barrels per day per year from surface mining;
- self-sufficiency from Oil Sands alone would require two plants per year during the period 1980-1990, i.e. $2 billion per year;
- in situ almost certain to be much more expensive although costs as yet unknown.

. Frontier Areas

- no good fix on costs byt extremely expensive to explore;
- major pipeline costs of at least $5 billion would be needed by 1985.

3. Alternative for Investment

. Provide Incentives or assistance to private sector through such means as:

- assurance of a favourable environment for profitable production through price and access to markets once reserves developed,
- provision of special write-off or other incentives during exploration stage,
- price rise permitted on present production to provide cash flow for investment funds,
- making proceeds of export or domestic tax on crude oil production available as low interest, interest free or forgiveable loans.

. Direct government action:
  - expansion of Panarctic or eventually a National Petroleum Company,
  - purchase of a major existing oil company,
  - joint ventures with the private sector,
  - prepayments for assured supplies,
  - long term sales contracts.

PRICING

1. Background

. Pricing of petroleum must be recognized as being much more complex than pricing of gas or electricity.

- petroleum production, refining, transportation and marketing is not a utility function, i.e. no franchise areas, many companies competing, etc.,
- many products are produced through processing of petroleum rather than a single output such as natural gas or electricity,
- petroleum is much more portable and traded on a truly international market which is non-existent for electricity, and only marginally so for gas.

. At the same time, many of the basic pricing principles to be applied to petroleum for the Canadian market have relevance in the pricing of other energy forms.

. OPEC pricing actions have raised world prices greatly but do not represent normal "market forces".

. These prices are greatly in excess of current cost of Canadian production.

. These cannot be regarded in the same light as cost or competitively generated price changes.

. This situation creates a problem of disposal of potential windfall profits amounting anywhere up to $4 billion per year.

. Pricing policy can be subdivided into three parts:

- the price level at which Canadian crude oil will be brought to the market,
- the degree and type of pricing differential to be established and maintained across the country,
- the sharing of any windfall profits.

2. Price Level

. Using February 1st export tax rate as an indicator, Canadian crude oil can currently be regarded as being priced about $6 per barrel below prevailing world levels. Two extreme strategies can be outlined with many intermediate positions possible. These are:

- strategy of maintaining prices in Canadian markets substantially below world prices,
- strategy of moving to world level petroleum prices, either immediately or in a series of staged increases.

3. Pricing Differentials

. If low price strategy is adopted, three policy options with respect to price differential exist:

- absolutely uniform price across the country, i.e. crude oil costs and transportation costs are both averaged out to one final price,
- uniform price across the country except for transportation differentials,
- low prices applicable to areas in Canada now supplied with domestic crude with the balance of the country being supplied at world prices.

. If high price strategy is adopted, prices adjust themselves across the country with everything being world price, plus or minus transportation differentials.

4. Allocation of Revenues

. Maintaining present price of Canadian crude oil placed in domestic markets has the effect of giving the "economic rent" available to the consumer of energy by way of low prices for his energy.

. If any movement from present Canadian prices toward world prices is permitted, optional ways of allocating the "economic rent" become available. In extreme cases these are:

- the Federal Government captures all "economic rent" via a tax,
- the producing provinces capture all "economic rent" via a tax or royalty,
- companies capture all the "economic rent" via price increases.

. In practice, some combination of all three ways is more likely.

5. Implications of Alternative Pricing Strategies

. In order to highlight the major factors which must be considered in dealing with the issue of petroleum pricing a more detailed assessment of the two extreme pricing strategies is given in this section.

. Neither strategy is being recommended.

. Strategy A

Set Canadian crude oil prices at present level plus an increase to the oil producers, and supply crude oil to all parts of Canada at a transportation-adjusted weighted average price of Canadian and offshore crude consumed. Such a policy has the following features:

- prices significantly below current world level,
- Canadian industry has advantage of lower priced energy,
- no major problems of changing tax sharing arrangement,
- higher profit allowed to the oil companies provides increased cash flow to encourage exploration in Canada,

- prices rise from present levels in Canadian-supplied areas and drop in offshore supplied areas, i.e. relative advantage given to Eastern Canada,
- if this policy causes Canadian prices for energy to be too far below U.S. prices, a Michelin-type reaction could occur,
- highest consumers of energy get the greatest benefit from low cost energy. "Economic rent" goes to consumer rather than to Governments.
- a Marketing Board must be involved in all crude oil buying and selling, export sales of products and product imports,
- price is less of a factor in encouraging conservation of energy,
- government revenues would decline as exports to the U.S. are cut back year to year,
- prices of energy will rise significantly as oil sands and Arctic oil replace conventional supplies in the future,
- without other constraints, prolonged low energy prices could create concentration of energy-intensive rather than skill-intensive industries in Canada,
- international oil companies could take advantage of Canada in their overall supply strategies.

. <u>Strategy B</u>

Move to world priced Canadian petroleum, allowing higher prices to oil companies with the balance being shared between the Federal Government and the producing provinces. Such a policy has the following features:

- domestic petroleum prices rise to world level,
- sharp rise in Canadian supplied areas but no change in offshore supplied areas,
- major additional revenue available to provinces which produce crude oil and/or the Federal Government,

- changes required in equalization payments if not complete revision of system,
- high users of energy are relatively more affected than low users of energy,
- price becomes a greater factor in encouraging conservation of energy,
- if U.S. energy prices are maintained below world level, Canadian industry would be at a competitive disadvantage,
- Marketing Board could operate in simpler fashion,
- prices need not change rapidly in the future as oil sands and frontier oil replace conventional sources,
- price increase improves cash flow to producing companies to encourage oil exploration.

6. Petroleum Marketing Board

. In order to implement effectively any pricing strategy a National Petroleum Marketing Board will be required.

. Its duties would depend upon pricing strategy adopted:
  - under a low price system the Board would be required to determine prices paid to Canadian producers, buy all Canadian crude oil and natural gas liquids, buy all required offshore crude oil, establish resale prices for all crude oil either on a "rolled in" basis or on an area differential basis. It could establish an export tax level for required export sales of Canadian refined products. It could purchase any required product imports and resell them to marketers at some established domestic price.
  - under a high Canadian price system, the Marketing Board could serve a less complex role, perhaps acting only as a price setting and tax collecting mechanism.

. Further discussion of a proposed National Marketing Board is provided in the paper on "Mechanisms".

natural gas

BACKGROUND DATA

POLICY ISSUES

C2. BACKGROUND DATA

Highlights

- The natural gas reserve life index for the Western Canada sedimentary basin has dropped sharply over the past decade as production has nearly tripled, while new reserve additions have declined. Deliverability of these reserves is estimated to level off by 1975-77 and to begin to decline before 1980.
- The major source of the additional gas supplies required in the near term to serve the expanding requirements of the Canadian market is expected to be the central region of the Western Canada sedimentary basin where improved economics resulting from higher gas prices has made drilling more attractive.
- If natural gas from the frontier regions and/or other new sources is not flowing to markets by the end of the 1970's, Canada will have to eliminate exports to meet domestic demand.
- Ontario's gas supply comes almost entirely from Alberta, supplied by Trans Canada Pipelines under long-term contracts it has with Ontario's distributors. These contracts provide for increasing volumes through 1974, sufficient to meet Ontario's anticipated growth requirements. In the normal course of events, provisions for increased volumes beyond 1974 would now be under negotiation.
- However, in an effort to increase the price of previously contracted-for gas at the wellhead, the Government of Alberta has to date refused to issue permits for additional volumes of gas to be removed from Alberta beyond those volumes covered by existing permits. These issues influence the outlook for immediate growth.

Supply and Demand

. Total supply of natural gas in Canada for the year 1972 was almost 3 trillion cu.ft. of which 81% was provided by Alberta. (see Table 1)

. Imports of natural gas have been reduced to an insignificant level, now amounting to only 0.5% of total supply.

. Exports of gas accounted for about one-third of total disposition in 1972 and Ontario demand for roughly one-half of domestic demand.

. A breakdown of sales by class of service in Ontario and Canada is given in Table 2 together with average retail prices. For Ontario, average price in 1972 was 76 cents per m.c.f.

Reserves and Exploration

. Estimates of Canada's proven gas reserves and ultimate recoverable potential are shown in Table 3.

. Proven reserves amount to only 10% of the total potential reserves and, to date, approximately three-quarters of the proven reserves still remain.

. The Western Canada Sedimentary Basin

- The natural gas reserve life index for the Western Canada sedimentary basin has dropped sharply over the past decade as production has nearly tripled, while new reserve additions have declined. The present appreciated cumulative initial reserve estimate represents a large fraction of the potential ultimate recoverable.

- This fact, coupled with recognizing that the point of inflection on the historical growth curve occurred over 10 years ago, indicates that the present status of the natural gas reserve picture for Western Canada may be far more advanced and mature than previously admitted a few years ago.
- In the near term, the major portion of the additional gas supplies required to serve the expanding requirements of the Canadian market are expected to be derived from the deep basinal and foothills areas of the central region of the Western Canada sedimentary basin.
- Improved economics resulting from higher gas prices has made drilling in the foothills and deep basin areas of western Alberta more attractive. Although the prospects for large discoveries are better here than in the plains, operations are much more expensive because of factors such as remote locations, deeper drilling requirements and the mounting costs of removing sulphur, a common element in many foothills fields. The economics of sulphur removal are further aggravated by prevailing low price levels for sulphur.
- The present volume of proved reserves is sufficient to meet existing export commitments and growing Canadian demands in the areas now served through the 1980's. However, by the late 1970's, the production capability (deliverability) of these reserves, rather than the reserves themselves, becomes a limiting factor.

- of major concern is whether or not Western Canadian deliverability can be maintained to sustain minimal (if any) growth levels for such period of time as is required to augment our supplies from frontier sources and/or synthetics. The implied challenge is to maintain deliverability from proven fields concurrently with finding and developing the remaining potential, having regard to the fact that approximately 60 per cent of the potential recoverable for the Western Canada sedimentary basin has already been discovered.
- The following graph shows a projection of deliverability from established reserves based on historical estimates of fully appreciated proved natural gas reserves for Alberta as presented in Table 8-4 by the Alberta ERCB 73-18 report and for the rest of Canada as presented in the Reserves and Productive Capacity Reports prepared by the Canadian Petroleum Association.
- On the basis of a levelling off in deliverability starting by 1975, the exportable surplus will be eliminated by 1980 unless the rate of finding gas in the Western Canada sedimentary basin increases sharply.

. <u>Frontier Natural Gas Resources</u>

- The estimates of proved gas reserves do not include any allowance for the discoveries in the Mackenzie Delta or the Arctic islands because much of the well data is confidential and it will be some time before pipelines will be extended to this area. Nevertheless, the source of new gas supplies in the long term is expected to include the Mackenzie Delta, the

Arctic islands and possibly the East Coast Offshore.

- It is evident that Canada may have to curtail authorized exports if supplies from Western Canada are to meet domestic demand and if natural gas from the frontier regions is not flowing to markets before 1980.
- If frontier gas and/or other source gas is not available by the end of the 1970's, production from Western Canada could be boosted to prolong the production peak so as to sustain the 1980 level of domestic demand until the mid-1980's. During this period there would be no supply allowance for export or for growth in domestic demand.

<u>Transportation</u>

. <u>Trans Canada Pipelines</u>

- Trans Canada Pipelines is by far the main source of natural gas supplied to distributors in Ontario. Table 4 provides a breakdown of gas sales by Trans Canada Pipelines.
- The Ontario distributors are Northern and Central Gas (Ontario Division), Consumers' Gas, Union Gas and Kingston PUC. Inter-City Gas is a Manitoba distributor which also serves the Fort Frances/ Rainy River area of Ontario.
- The Alberta Government is not expected to authorize the removal of additional gas from the province until higher prices are paid. Producers are reluctant to commit new reserves to Trans Canada Pipelines until satisfied that Trans Canada Pipelines can obtain the necessary permit from

the Alberta Government.

- Trans Canada Pipelines is now offering to purchase new gas reserves at significantly higher field prices than in the past. In addition, it has offered to transport, for its Canadian customers, any natural gas reserves they may elect to purchase on their own behalf.

. Frontier Pipelines

- The delivery capacity of the proposed Gas Arctic (the Canadian Arctic Gas Study) pipeline is in excess of 4 bcf/day based on half its supply from the Mackenzie Delta and half from Prudhoe Bay (i.e. Alaskan North Slope). Minimum volume required to support 1¼ bcf/day production from Canadian reserves is approximately 7 trillion cubic feet. Total capital is estimated at $5 billion, including $3.5 billion during the first 3 years of construction to bring the system on stream and the remainder during the next 2 years for added compressor hp to achieve full design capacity.

- It is expected that $1 billion will be equity and $4 billion debt capital comprising a combination of 20 or 25 years first mortgage bonds, some junior debt money which may have provisions for conversion to equity and bank loans.

- The pipeline tariff to 60th parallel (Alberta border) is estimated at 40¢/Mcf.

- The Polar Gas Project will involve 3200 miles of up to 48-inch diameter pipe to deliver 4 1/2 bcf/day of natural gas from the Arctic islands at an operating pressure of 1750 psig. The estimated cost is between 5 and 6 billion dollars. The required threshold volume of natural gas is estimated at 25-30 trillion cubic feet.
- At the present time, Gas Arctic and Polar Gas each awaits the discovery of more gas reserves.

TABLE 1

SUPPLY AND DISPOSITION OF GAS 1972

Supply (in billion cubic feet)		
Net Canadian Withdrawals:		
N.B.	0.1	
Que.	0.2	
Ont.	12.4	
Sask.	68.5	
Alta.	2,385.3	
B.C.	432.2	
NWT & Yukon	14.6	
		2,913.3
Imports		15.8
TOTAL SUPPLY		2,929.1

Disposition (in billion cubic feet)		
Sales:		
N.B.	0.06	
Que.	58.2	
Ont.	552.8	
Man.	59.8	
Sask.	88.0	
Alta.	268.8	
B.C.	118.3	
		1,146.0
Exports		1,007.1
Pipeline Fuel, Shrinkage, Losses, etc.		776.0
TOTAL DISPOSITION		2,929.1

TABLE 2

CANADIAN NATURAL GAS SALES, 1972 (retail)

Average Retail Prices and Number of Customers

	Average $/Mcf	No. of Customers Dec. 31, '72
N.B.	3.14	1,100
Quebec	0.98	198,440
Ontario	0.76	898,662
Manitoba	0.65	142,600
Saskatchewan	0.49	158,371
Alberta	0.33	353,274
B.C.	0.77	286,648
TOTAL CANADA	0.65	2,039,095

Natural Gas Sales by Class of Service
(in million cubic feet)

	Ontario	Canada
Residential	117,138	280,811
Commercial	113,774	241,581
Industrial	321,851	623,405
TOTAL	552,763	1,145,797

TABLE 3

CANADA'S GAS RESOURCES
(in Trillion Cubic Feet)

	In Place	Recoverable	Cumulative Production	Remaining
1. Proven Reserves (a)				
NWT	2.0	1.3	-	1.3
W. Can.	116.5	69.1	17.8	51.4
E. Can.	1.1	1.0	0.7	0.3
	119.6	71.4	18.5	52.9
2. Potential Resources (b)				
Arctic Is. & NWT	-	341.7	-	341.7
W. Can	-	43.7	-	43.7
E. Coast	-	326.1	-	326.1
		711.5		711.5

(a) Canadian Petroleum Association (Dec. 1972)

(b) Geological Survey of Canada (March 1973) estimates of ultimate recoverable potential less proved reserves.

Above cited in Table, p. 32, An Energy Policy for Canada, Phase 1, Vol. 11.

CANADIAN NATURAL GAS YEARS OF SUPPLY

(Year end proven reserves ÷ annual production)

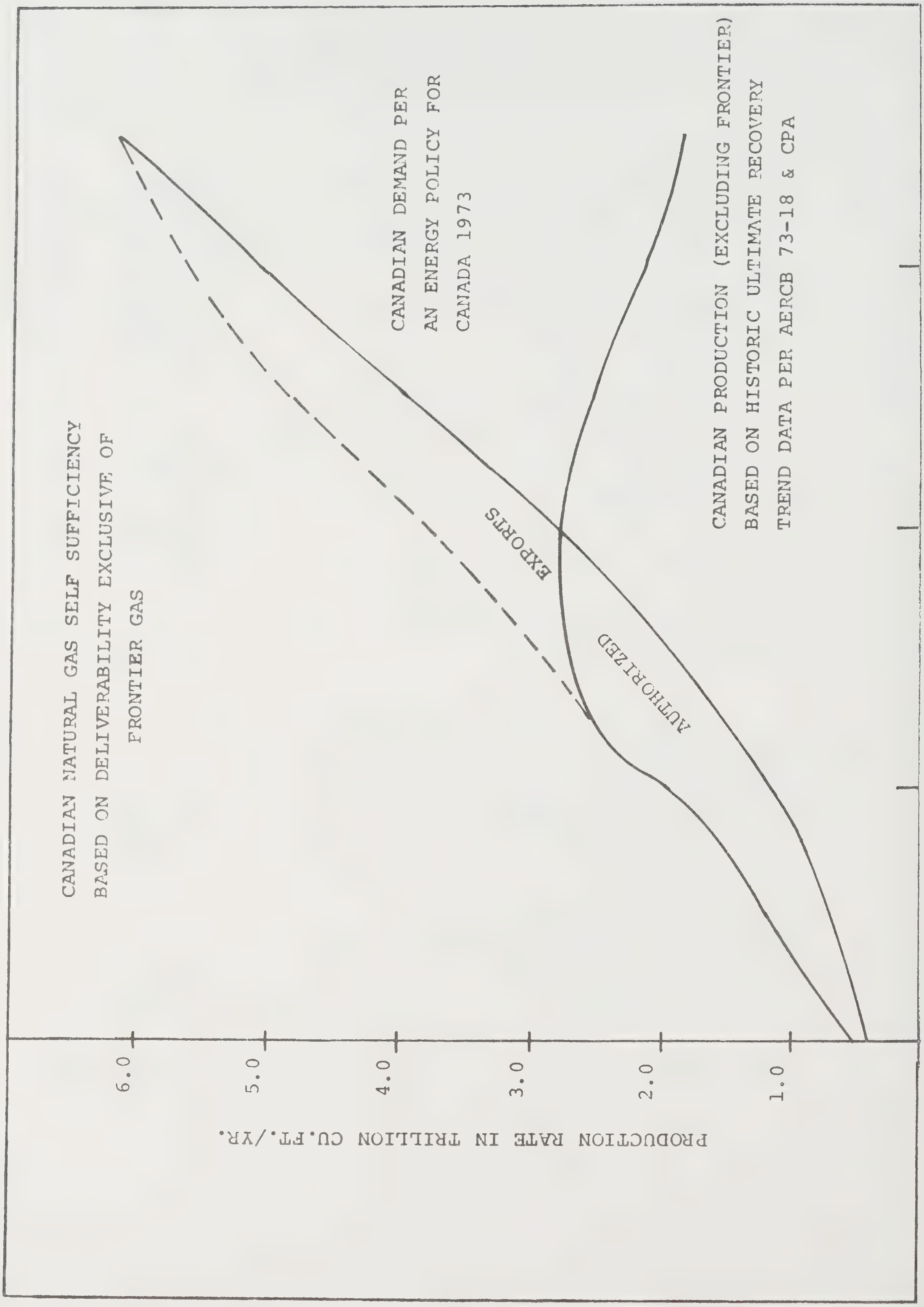
1960	52 years
1965	33 years
1970	29 years
1972	23 years

TABLE 4

TCPL ANNUAL GAS SALES PER CONTRACT PERFORMANCE BY CUSTOMERS

(volumes in MMcf)

Canadian Sales	1973-74	(%)
Saskatchewan Power Corporation	33,130	(3.1)
Inter-City Gas Limited - Manitoba	4,500	(0.4)
Greater Winnipeg Gas Company	46,285	(4.3)
Plains-Western Gas(Manitoba) Ltd.	8,400	(0.8)
TOTAL WESTERN	92,315	(8.6)
Inter-City Gas Limited - Ontario	3,680	(0.3)
Northern & Central Gas Corp. Ltd.(Ont.Div)	112,030	(10.4)
Consumers' Gas Company	293,041	(27.2)
Union Gas Limited	230,207	(21.3)
Kingston P.U.C.	2,125	(0.2)
TOTAL ONTARIO	641,083	(59.4)
Gaz Metropolitain, inc. (Quebec)	73,324	(6.8)
TOTAL CANADIAN	806,722	(74.8)
Export Sales		
Midwestern Gas Transmission Co.	119,088	(11.0)
Great Lakes Gas Transmission Co.	117,340	(10.9)
Inter-City Gas Ltd.	7,240	(0.7)
Michigan Wisconsin Pipe Line Co.	18,250	(1.7)
Niagara Gas Transmission Ltd.	5,520	(0.5)
Vermont Gas Systems, Inc.	4,230	(0.4)
TOTAL U.S. EXPORT	271,668	(25.2)
TOTAL SALES	1,078,390	(100.0)


CANADIAN NATURAL GAS SELF SUFFICIENCY
BASED ON DELIVERABILITY EXCLUSIVE OF
FRONTIER GAS
CANADIAN DEMAND PER
AN ENERGY POLICY FOR
CANADA 1973
CANADIAN PRODUCTION (EXCLUDING FRONTIER)
BASED ON HISTORIC ULTIMATE RECOVERY
TREND DATA PER AERCB 73-18 & CPA
EXPORTS
AUTHORIZED
PRODUCTION RATE IN TRILLION CU.FT./YR.
6.0
5.0
4.0
3.0
2.0
1.0
1960
1970
1980
1990

POLICY ISSUES

SUMMARY AND CONCLUSIONS

- The provincial regulatory process is capable of promoting or restricting the end-use of gas as an energy source or petrochemical feedstock.
- Canada now has a capability for self-sufficiency in gas but this will be lost by the end of this decade unless large new reserves are added.
- Gas utilities should be directed to distinguish between the prices of 'old' and 'new' gas in negotiating supply contracts.
- Gas prices must relate only to the full cost of supply, and not linked to world oil prices.
- Exportable gas, defined by the National Energy Board's formula, should make an appropriate revenue contribution to the stability of domestic prices and the financing of exploration, development and production of new supplies.
- Such surplus revenues can be distributed by industry under regulatory controls or by a national marketing agency operating in interprovincial and international transactions.
- Agreement on a continuing mechanism for Federal/Provincial energy policy development is essential if the jurisdictional problems prevalent in the Canadian gas industry are to be resolved.

Use of Gas

- Natural gas is a versatile primary source of energy and an important petrochemical feedstock.
- Gas users have historically decided on the end-use of gas based on gas properties, supply conditions, preferences and price.
- Other than under emergency conditions, as specified in Bill C-236, the federal government appears to lack jurisdiction over the end-use of gas in Canada.
- Environmental and conservation concerns have raised the question of the most effective use of gas in both the domestic and export markets. Restriction on end-use may raise related questions of control over production in the field.
- The provincial regulatory process is capable of promoting or restricting gas uses.

Capability of Self-Sufficiency

- Canada has a capability for self-sufficiency in gas. However, inadequate reserve additions and deliverability problems threaten the existing capability for self-sufficiency. If natural gas from the frontier regions or other new sources is not flowing by the end of the 1970's Canada will have to eliminate exports to meet domestic demand.

Jurisdiction

. In addition to physical and economic problems, jurisdictional problems complicate the function of Canada's gas industry.

. Jurisdictional problems arise essentially from grey areas in the British North America Act with respect to responsibility for such problems as:

- interprovincial and international trade and transportation of liquid and gaseous hydrocarbons and electricity.
- establishment of permanent and formal mechanism for federal-provincial energy policy development.

. Since constitutional rights and obligations are non-negotiable and since constitutional problems require constitutional solutions, agreement on the structure of a permanent mechanism for federal-provincial energy policy development is essential.

Pricing

. The fundamental distinction between resources and reserves should be reflected in the ownership question. Under the rule of capture, resources change their status to reserves with a resulting change in ownership; in other words, the finder of a resource becomes the owner of a reserve.

. Compensation should be paid only for functions exercised. For example, a gas producer should not expect to reap benefits from the marketing efforts of an exporter.

. Gas prices should cover only the cost of the functions of exploration, development and production including a reasonable return. The pricing of "old or flowing" gas is and should continue to be a matter of the terms and conditions of a contract.

. A certain price relationship between gas and other energy forms is no reason for determining gas prices. There is no reason to link domestic gas prices to hypothetical world oil prices.

. Within the framework of the National Energy Board Act, surplus gas exports should make an appropriate revenue contribution to Canada. In fact, the revenue contribution by the gas exporters should become the raison d'etre for the continued existence of export licences.

. Export revenues exceeding the cost of gas plus the cost of service including a reasonable return can stabilize domestic prices and help to finance exploration, development and production of new gas supplies.

. Surplus revenues could be disposed of by industry under adequate regulatory controls or by a national marketing agency which would purchase, sell and price gas destined for interprovincial and international trade. Export tax arrangements raise problems of the distribution of tax revenues.

. Wellhead price control would not appear to be necessary if any of the aforementioned alternatives is adopted.

coal

SUMMARY AND CONCLUSIONS

. Although Ontario has always enjoyed excellent relationship with its American suppliers of coal, recent developments in the energy sector have resulted in a review of the Ontario position relative to the virtually total dependence on U.S. sources for present and future coal requirements.

. Currently, about $96 million annually is spent by Ontario Hydro for coal and within five years this will reach about $225 million.

. Three major reasons dictate a gradual shift away from total reliance on American coal to a more balanced Canadian and American source of supply:
  - the need to achieve security of supply,
  - self-sufficiency requires an expansion of the coal industry in Canada,
  - the prospect of obtaining greater supplies of U.S. coal is in question.

. In order to assist in this shift of source of supply, Ontario Hydro will undertake a $10 million test program designed to determine the feasibility of mining, transporting and burning Western coal in Ontario Hydro's generating stations.

. If successful this could result in the negotiations of contracts for some 5-million tons of Western coal per year or about one-quarter of total Canadian requirements. The estimated cost is 50% higher than for current U.S. supply, but is of much lower sulphur content.

. Since transportation is a key factor in the economics of Western coal, continued efforts must be made to lower transportation costs.

- In Ontario, development of the Onakawana Lignite deposit to fire a 900 MW generating station is under serious examination, including a detailed assessment of its social and environmental impacts in the area.
- In order to obtain the maximum benefit from the large reserves in Canada over the long run, further research and development into gasification and liquefaction of coal should also be encouraged.

BACKGROUND DATA

Highlights

- Coal is the most abundant fossil energy resource in Canada with about 93% of the reserve of 118 billion tons located in Saskatchewan, Alberta and British Columbia.
- Canadian coal production of all types, in 1972, was 20.7 million tons valued at $15.0 million. 8.3 million tons were exported to Japan. 20.2 million tons were produced in the first 11 months of 1973.
- Canada imported 19.3 million tons from the United States in 1972 and 15.3 million tons in the first 11 months of 1973.
- The United States is self-sufficient in coal and is thought to have 70% of the western world's coal supply.
- Almost all of Ontario's consumption of about 18 million tons is imported from the United States, primarily from West Virginia and Pennsylvania. Of Ontario's consumption roughly 50% is used for electrical generation, 47% for industry purposes, and the balance-commercial and residential.
- By 1978 Ontario Hydro estimates it will require about 18 million tons per year. At the present time Hydro has contracts for about 9 million tons annually from Pennsylvania and West Virginia. They are currently examining the feasibility of increasing these supplies to about 12 million tons per year. This will leave an additional requirement of between 5 and 6 million tons annually by 1978.

- 90% of the coking coal used to make coke in Canada is imported from the U.S. DEVCO in Sydney, N.S. uses a combination of U.S. and N.S. coal to produce coke for nearby steel mills. Unless current methods of steel-making change substantially (considered unlikely over the next decade) the demand for coking coal will rise in proportion to steel output.
- Prices from U.S. sources were fairly stable through most of the 1960's, but rose sharply in 1970 and 1971, roughly doubling.
- Coal production has a high labour content, ranging up to fifty percent of the selling price, plus, coal prices are more inflation sensitive since they are subject to contract price escalation provisions.

Western Canadian Coal

- Coal reserves in Western Canada amount to about 118 billion short tons. With Saskatchewan having approximately 12 billion, Alberta 47 billion, and British Columbia 59 billion. About 3% of the reserves are located in Nova Scotia and the Yukon and Northwest Territories.
- Reserves of low and medium volatile bituminous coal in Western Canada are estimated to be 86 billion tons, of which a small percentage is economically recoverable metallurgical grade coking coal. Reserves of thermal coals exceed 30 billion tons, including the highly volatile bituminous non-coking coals in British Columbia and the Alberta Foothills, the Alberta sub-bituminous coals and the Saskatchewan lignites.
- Increased cost of burning Western Canada coal would be in the order of $10 million per year or more. The Ontario Hydro system now contains approximately 6500MW of fossil plant.

. Adequacy of supply of Western coal is affected by two geological factors which hamper the evaluation and production of Canadian coal resources:

- the vast deposits that underlie the Prairie region of Alberta and Saskatchewan (about 21 billion tons) are almost universally buried beneath thick glacial deposits. This factor affects the prospects for strip mining;
- the coal seams of the high ranking coal deposits of the mountain coal fields comprising the bulk, about 90 billion tons of Canada's resources, are severely faulted and folded because of the geological uplift of the Rocky Mountains.

. The cost of production of the Prairie strip mines of Saskatchewan and Alberta are amongst the world's lowest. Cost of the surface mines of the mountain coal fields also compare favourably with similar operations elsewhere.

. Western bituminous coal could be used in the stations with either a penalty on output or with oil or gas upgrading. The de-rating of existing facilities would result in approximately a 50% loss of capacity.

Onakawana Lignite

. In Ontario, the only proven reserve of coal that is substantial and potentially economic is the Onakawana Lignite deposit between Cochrane and Moosenee. The Ontario Government, in collaboration with Ontario Hydro and the Manalta Coal Company is taking a harder look at a proposal to fire a 900 MW generating station and the recent increase in energy costs has obviously improved its economics.

. The following table illustrates the relative characteristics of the Onakawana deposit:

		B.T.U./ lb.	Moisture	Sulphur %
Onakawana	lignite	5000	49%	1.6/.84
Saskatchewan	"	7200	33%	.6
Eastern Alberta Plains	Sub Bituminous	8300	27%	.6
Western Alberta Plains	"	9700	19%	.6
Alberta Foothills	Bituminous	10,900	10%	.6
American (Imports)	"	13,000	5%	2.5

. Task Force Onakawana have also suggested alternatives uses such as gasification on site, steam supply for a heavy water plant. They also pointed out the critical importance of giving full consideration to the social and environmental impacts of any development of that resource. Further work is proceeding on these proposals.

The Dominion Coal Board

. The Coal Board was established in 1947 to advise on all matters relating to the production, importation, distribution and use of coal in Canada. In 1969 to 1970, the Board was dissolved and the Coal Production Assistance Act and the Canadian Coal Equality Act were repealed. The functions and responsibilities of the Board were assumed by the Department of Energy, Mines and Resources.

. The basic Federal program of subvention aid was discontinued for the Maritime Provinces in 1968 and for the Western Provinces in 1971, as was loan assistance. However, alternate assistance is being provided in Nova Scotia through the Cape Breton Development Corporation and in New Brunswick through a five-year program to phase out coal production.

- The new Federal coal policy is to promote the economic viability in the coal industry through research and development and co-operative efforts with industry in the areas of mine technology and marketing, with particular emphasis on economic bulk transport from mine to markets and sulphur removal at the minehead.

<u>Ontario Hydro Test Program</u>

- In order to achieve Ontario's objectives, a test program utilizing Western coal will be carried out during 1974.
- An order has been placed with BYRON Creek Collieries in Southeastern British Columbia for 250 thousand tons of coal to be delivered in 1974.
- Negotiations are under way with two Alberta Collieries for an additional 250 thousand tons.
- The coal will be tested at Lambton, Nanticoke, Lakeview and Thunder Bay; it will be shipped by rail to Thunder Bay and by boat to southern Ontario at a rate of approximately 7000 tons per week.
- Because of the distances and high transportation costs, the coal will cost approximately 50% more than coal from U.S. product, but has a much lower sulphur content (see table).
- In order to minimize the loss of capacity, the coal will be burnt along with either oil or gas. A gas supply of approximately thirty billion cubic feet per year would permit the burning of some five million tons of Alberta coal per year.
- An extensive review has been undertaken of the costs of transportation of coal and various methods of moving it in the future.

nuclear power, uranium and heavy water

SUMMARY AND CONCLUSIONS

- In an effort to achieve a national capability for self-sufficiency, Ontario strongly supports the rapid development of nuclear energy throughout the nation.
- Ontario is heavily committed to the development of a nuclear capability and has currently committed over 5 billion dollars to this end.
- In addition to this amount is a recently announced 750 million dollar extension to the heavy water facilities at Bruce.
- In view of this investment and the importance of nuclear energy to the growth of Ontario and the nation, it is extremely important that national standards are set which guarantee Canadian uranium requirements will be met and which identify exportable surplus.
- Incentives should be given to encourage uranium exploration which has fallen off dramatically in recent years and a means must be found to ensure maximum upgrading of uranium in Canada.
- In order to assure the continuing availability of uranium at reasonable cost to Canadian users, Ontario supports its production and marketing as a national commodity controlled in the national interest.

BACKGROUND DATA

Nuclear Generation Program

- Although Canadian nuclear generation of electricity is currently confined to Ontario and Quebec it is anticipated that there will be an increasing interest in other sections of the country. A forecast of installed nuclear capacity in Canada to the year 2000 is given in the following table.

Forecast of Nuclear-Electric

Generating Capacity in Canada

(Megawatts)

Date	Atlantic Provinces	Quebec	Ontario	Prairie Provinces	British Columbia	Total
to 1980	-	600	5,500	-	-	6,100
1981-85	1,200	1,200	8,250	600	1,600	12,850
1986-90	1,800	5,600	10,650	1,200	1,600	21,450
1991-95	2,400	14,000	13,200	1,200	4,800	35,000
1996-00	3,000	19,800	25,200	1,800	8,400	58,200
Total	8,400	41,200	62,800	4,800	16,400	133,600
Percent of Total Electrical Generating Capacity						
	42	46	63	10	55	46

- Ontario currently has installed capacity of some 2200 megawatts of nuclear generation. The experience of the first four units at Pickering has been exceptional.

. Units one to four at Bruce, which have a capacity of 750 megawatts as against the Pickering 500 megawatts units, are under construction.

. The doubling of the two plants, an additional 2000 megawatts at Pickering and 3000 megawatts at Bruce, has been announced.

. The Capital Expenditures for these stations are as follows:-

Capital Expenditures - Nuclear Stations

	Station	Total Cost ($M)	Capacity (MW)	Last Unit Inservice (Year)
Pickering	1-4	676	2056	1973
	5-8	1166	2056	1982
Bruce	1-4	1251 *	2980	1979
	5-8	1819	2980	1983

* Expenditures up to October 1973 - $425M

. Originally Pickering units one and two were undertaken as a joint venture between A.E.C.L., the Province of Ontario and Ontario Hydro with the following division of costs-

AECL contribution (33%) $144.9 mill

Province contribution (27%) $120.7 mill

. Since Pickering has been such a success, pay back up to November 1973 based on the Pickering/Lambton agreement, to the Province and A.E.C.L. by Ontario Hydro has been-

AECL $12.6 mill

Province $10.3 mill

. Ontario Hydro estimates that the probable nuclear capacity of Ontario for the year 2000 will be less than the stated 62,800 megawatts but in excess of 50,000 megawatts, with a cumulative fuel demand of some 85,000 tons of uranium.

. Foreign sales of CANDU reactors to date have been as follows-

<u>In Service & under construction</u>	<u>Capacity (MW)</u>
Pakistan	137
India (Rajasthan)	2-200
(Madras)	2-200
<u>Recent Sales</u>	
South Korea	600
Argentina (letter-of-intent)	600

These are all CANDU pressurized heavy water reactors.

. The only other Canadian unit at the moment outside of Ontario is Gentilly 1, a 250 megawatt CANDU boiling light water reactor in Hydro-Quebec.

Uranium

- At the present time only three Canadian companies are producing uranium and two of these are located in Elliot Lake where eighty five percent of the production of about 5,200 tons per year is produced. The available capacity of the three milling plants is estimated at 6000 tons per year, although all producers have plans for expansion.

- Canadian production makes up 21% of world production. Over 80% of Canadian reasonably assured reserves are located at Elliot Lake. At the peak of the Canadian uranium boom, in the late 1950's, there were twenty three producing mines in Canada. Current reserve figures are as follows:

	PRICE U_3O_8 PER LB.	CANADA (TONS)	ONTARIO (TONS)	WORLD (TONS)
Proven	- $10	241,000	192,000	1,140,000
	$10 - $15	158,000	142,000	1,350,000
Estimated	- $10	247,000	162,000	1,100,000
	$10 - $15	284,000	185,000	1,350,000
Total	up to $15	930,000	681,000 *	4,940,000 **

* Excludes Bancroft reserves at about 1% of Total Canadian Reserves.

** Subject to 1973 correction.

- Permits for uranium exploration in Ontario fell from 120 issued in the 1967/68 season to 3 in 1972.

. Best current estimates indicate that the United States will not be able to meet its own requirements for uranium from domestic production facilities within the present decade. Similarly, in other producing countries, new production facilities, based on reserves yet to be discovered, will be needed around the end of the present decade. In other words, renewed exploration for uranium on a substantial scale will be needed very soon. However, the industry, with soft current markets, has no immediate incentive to explore.

. Ontario Hydro does not require large additional quantities of uranium before the year 1980. However, to bring new production facilities on line, substantial lead times are required. For example:

- between six and ten years before the production date exploration for uranium must be commenced.
- about five years before the production date, a mineral deposit must be discovered.
- about three years before the required production date, the reserve must be sufficiently well delineated to allow a firm production decision to be made.

. Assuming no major change in technology by the year 2000, Ontario Hydro's installed capacity at that time will require, during the lifetime of the plant in service, an amount of uranium equal to all currently proven Canadian reserves at under $10 per pound.

. Outstanding export contracts for Canadian uranium for delivery during the next ten years now total over 70,000 tons.

. Under the Ontario Mining Act, section 113, unless a mineral is "full processed for the Arts", the Ontario Government required prior authorization for export of the mineral from Canada on penalty of forfeiture of title to the mining land. To date all producers in Ontario who have mined and processed uranium into concentrate for subsequent export from Canada have applied for and been granted exemptions from this Act.

Heavy Water

An assured supply of heavy water is vital to the CANDU nuclear program. Approximately 1 ton of heavy water is required to commit each 1 MW of installed generation capacity.

- To meet the in service dates of planned nuclear-electric units Ontario Hydro requires the output from eight 400 ton heavy water units from January 1, 1978 onwards.
- Between now and 1978 heavy water will be in extremely short supply.
- At the present time the following heavy water plants are in service:

Port Hawkesbury	400 tons per year
Bruce 1 & 2	800 tons per year

- Planned

		In Service
Glace Bay	400 tons per year	1975
Bruce 3 to 8	2400 tons per year	1978/9
Gentilly	800 tons per year	1979

- Bruce 1 and 2 were placed in service in 1973 and produced over 300 tons of heavy water.
- Existing heavy water in Ontario Hydro units came primarily from the U.S. and Port Hawkesbury with some supplies from Russia and Sweden.
- Ontario's current capital construction program for nuclear plant is based entirely on Ontario Hydro.

. The investment in heavy water is as follows:

	Millions of Dollars		
1973	Bruce 1 & 2	$253M	(purchased from AECL overtime)
1977/78	Bruce 3 to 8	$250-270M	in 1973 dollars
		(280M)	(in actual dollars)

hydro-electricity

SUMMARY AND CONCLUSIONS

. In Canada since hydro-electric generation offers considerable advantages,being relatively clean, non-depleting, indigenous, more flexible in operation and less exposed to inflationary trends, development of additional capacity in an economic and environmentally acceptable manner should be encouraged.

. Undeveloped hydraulic resources amount to approximately twice the current national capacity. Economic development is contingent on

- research into DC transmission
- strengthing of interprovincial connections and further development of a national grid.

. In the examination of future hydro-electric schemes in Ontario, adequate opportunity will be given to assess the social economic and environmental impacts so that the best possible use can be made of available resources in the Province.

BACKGROUND DATA

Highlights

- Historically in Canada, most electric energy has been produced by hydro-electric generation. At the end of 1972, the total installed capacity in Canada was 32,500 MW and provided 75% of total electric energy.
- The remaining undeveloped potential capacity has been estimated between 60,000 MW and 85,000 MW (Federal Energy Policy Paper), but these sites are distant from load centres and concentrated mainly in Labrador, Quebec, Manitoba, British Columbia and the Yukon. Their inaccessability and high transmission costs have made them uneconomic to develop to date.
- In Ontario, the transition from hydro-electric sources to thermal generation has proceeded rapidly. In 1960, 99% of energy generated by Ontario Hydro was from hydro-electric stations but by 1972, this figure had dropped to 54% as shown in the following table.

HYDRO-ELECTRIC GENERATION 1963 - 1972

YEAR	CAPACITY* MW	OUTPUT GWh	%TOTAL OUTPUT %
1963	5031	26,315	77.3
1964	5039	27,135	76.0
1965	4985	29,540	73.3
1966	5112	33,659	76.4
1967	5197	34,195	72.5
1968	5512	35,072	68.9
1969	5754	36,663	66.0
1970	5966	35,714	61.3
1971	6258	34,843	55.2
1972	6117	37,617	54.2

* 98% dependable capacity at year end.

- It is estimated that 8,000-9,000 MW of additional capability exists in Ontario, either as extensions to existing stations or new sites. Only one significant source remains, that of the Albany River, but its development is not believed to be economic or environmentally acceptable at the present time.
- Studies also show that, provided transmission costs are not excessive, potential hydraulic sites are more likely to be economic if developed for peaking purposes. This method of operation leads to greater environmental concerns due to increased erosion of river banks. None of these sites are included by Ontario Hydro in their generation program up to 1983.
- Development of other sites for pumped-storage capacity is possible but the potential in Ontario is small and uneconomic until large amounts of excess nuclear energy become available in the late 1980's.

Undeveloped Hydraulic Capacity in Ontario

A preliminary outline of the potential capacity and cost of development of Ontario's remaining major hydro-electric sites, both as possible new generating sites and as extensions to existing generating stations is shown in the following Table: (see page 4)

Hydro - Electric Development Proposals in Ontario and Capital Costs

River	Scheme	Peak Capacity (MW)	Capacity Factor (%)	Capital Cost ($M.1973)
Major Systems				
Albany	15 plants with 3 river diversions	3280	60-70 average	?
Abitibi	Abitibi Canyon Extension	820	18	180
	Lower 9 mile Rapids	300	21	100
	Coral Rapids	186	27	100
	Other Rapids Extension	180	27	32
	Long Sault Rapids	82	33	45
	TOTAL	1568		457
Mattagami	Grand Rapids	317	28	90
	Smoky Falls Redev.	260	35	80
	Little Long Extension	125	35	20
	Harmon Extension	140	35	21
	Kipling Extension	140	35	21
	TOTAL	982		232
Moose	Grey Goose	447	27	140
	Renison	447	27	130
	TOTAL	894		270
Minor Systems				
Missinaibi	Thunderhouse Falls	45	48	30
	Long Rapids	102	49	50
	Mileage 66	82	40	50
	Mileage 25	82	40	50
	TOTAL	310		180
Mississagi	Gros Cap	268	17	100
	Red Rock Falls Extension	37	35	14
	TOTAL	305		114
White	Chigamiwingum Falls	57	42	25
	Umbata Falls	57	41	22
	Chicagouse Falls	28	38	16
	TOTAL	142		63
Little Jackfish	Mileage 12.5	63	40	40
	Mileage 7.5	75	42	38
	TOTAL	138		78

cont.

River	Scheme	Peak Capacity (MW)	Capacity Factor (%)	Capital Cost ($M.1973)
Pic	Mileage 9	67	18	?
	Mileage 74	60	18	?
	TOTAL	127		?
English	Maynard Falls	90	41	50
Montreal	Ragged Chute	84	19	40
	GRAND TOTAL	7920		
Additonal preliminary rough outline proposals not costed				
Madawaska	Highland Falls	92	18	-
Niagara	SAB 2 Extension	199	-	-
	SAB 3	501	28	-
Ottawa	Otto Holden Ext.	156	4	-
	Des Joachims Ext.	640	3	-
	TOTAL	1012		

Pumped Storage Capacity in Ontario*

. In 1960, Ontario Hydro made a preliminary appraisal of possible pumped storage sites near populated areas, having heads in excess of one hundred feet, and having either an established headpond or tailpond. Sites meeting this specification - which still describes the needs of a natural site if that site is likely to be economic - were few in number. It was concluded that some of them were sufficiently attractive that they were suitable for more extensive future investigation. However, it was considered that the need of the power system for this type of capacity was not likely to arise for many years in the future.

* Source: Ontario Hydro Submission to Ontario Energy Board, December 1973.

. Since then, further work has been limited to study of two major schemes: a pumped storage at Delphi Point, and a scheme involving transfer of water between Lake Ontario and Lake Erie, named for convenience sake, as the Jordan pumped storage. As a result of these studies, Ontario Hydro acquired property at Delphi Point and is holding it for future development. No property has been acquired for the Jordan scheme.

. Another proposal has been made, but not yet studied in detail by Ontario Hydro: The excavating of subterranean storage caverns for water storage and establishing underground pumping-generating stations. By this means, it is hoped to gain the economic advantage arising from use of large heads, i.e., large difference in elevation between the upper and lower storage reservoirs.

. All these hydraulic pumped storage schemes suffer from the loss of energy they incur: more energy is consumed in the pumping process than is recovered in the generating process. Therefore, to be economic, they must have a capital cost per kilowatt generated that is much lower than alternative sources of power, and/or the value of the energy that they generate must be substantially greater than the value of the energy they consume while pumping.

. The schemes studied by Ontario Hydro do not have very low capital costs per kilowatt generated, and therefore they will be uneconomic until such time as large amounts of low-cost surplus nuclear energy become available to provide pumping energy during nights and week-ends. This is considered unlikely to arise until the late 1980's at earliest.

Major Hydro-Electric Developments by Province

Newfoundland

. Two 475 MW units were commissioned at Churchill Falls during 1972, for a total capacity of 1,900 MW with virtually all being purchased by Hydro-Quebec. The additional 950 MW accounted for just under 50% of Canada's total new hydro-electric plant in 1972. Six more units at Churchill Falls will be placed in service by 1975. When completed, the 5,225 MW plant will be the largest generating station in Canada.

Quebec

. Three hydro-electric developments, Rapide des Iles Station, Manic 3, and James Bay will provide Quebec with 9,500 MW additional capacity by 1984.

Ontario

. Ontario Hydro's two-unit 87 MW Arnprior Station on the Madawaska River, is the sole development and is expected to become operational in 1976.

Manitoba

. Future plans call for exclusive development of the province's hydro-electric base. The more significant projects include:

- the Kettle Generating Station on the Nelson River is more than half completed. 168 MW of power will be produced from six units to be included as part of a control structure which is being constructed to regulate and control the levels of Lake Winninpeg. The powerhouse is expected to commence service in 1976 and be completed in 1977;

- the 10-unit, 980 MW Long Spruce Generating Station, located on the Nelson River about 14 miles downstream from Kettle Rapids. The first power should be available around 1978. Development at this site was made possible by the license to Manitoba Hydro to divert up to 30,000 cfs from the Churchill River flow through the Rat and Burntwood Rivers into the Nelson River.

<u>British Columbia</u>

. British Columbia's hydro-electric facilities were expanded substantially in 1972 with 520 MW additional capacity, or approximately 27% of the country's total 1972 hydro additions. The Gordon M. Shrum Station on the Peace River and redevelopment of the Whatshan Station on the Whatshan River accounted for more than 95% of the increase.

. Other projects include: a ninth unit (300 MW - 1974) and tenth unit (300 MW) at the Gordon M. Shrum Station; the 500 MW Kootenay Canal project on the Kootenay River (1975-1976) and the 1,740 MW Mica Dam project on the Columbia River (1976-1977), with two additional 435 MW units at Mica Dam being developed.

national grid

SUMMARY AND CONCLUSIONS

- In 1967, the report of the Federal/Provincial Committee on Long Distance Transmission concluded that construction of a nationally integrated network was not justified on economic and technical grounds but that regional (interprovincial) ties would be developed whenever they were justified.
- The Ontario Government supports the policy of gradual development and strengthening of interconnections between provinces as the need arises in the interests of security of supplies.
- Should a more extensive grid than is currently evolving be considered to be in the national interest, assistance should be given to enable the construction of interprovincial interconnections which cannot be justified by the immediate needs of the utilities involved or by the building of higher capacity interconnections than can now be justified on narrow economic criteria.
- The Federal Government should make further efforts to develop high voltage D.C. transmission systems in order to facilitate this program of interprovincial ties.
- The basis of pricing of interprovincial and international exchanges of power should be considered by a Federal/Provincial forum which would take account of the national interest in such exchanges.

BACKGROUND DATA

Highlights

. Interconnections between electric utilities are normally based on mutual benefits to the parties involved:

  - improved reliability and stability of each system,
  - more economic use of available capacity,
  - lower individual reserve margins,
  - economies of scale through the use of larger generating units,
  - opportunities to purchase and sell surplus power.

. For Canadian utilities,most of these benefits have been secured through ties with neighbouring U.S. utilities; the east-west direct inter-provincial links are generally still weak. Indirect inter-provincial exchange of power through the U.S. interconnected systems is also possible.

. There are, currently, only two significant gaps in inter-provincial ties - between Saskatchewan and Alberta and between Ontario and Quebec although, in the latter case, Ontario is connected to an isolated part of the Hydro-Quebec system.

Ontario Hydro Interconnections

. A list of the existing and planned 60Hz inter-connections at 115 kV and above is shown in the attached Table 1. The interconnections with the isolated part of the Hydro-Quebec system and Manitoba Hydro are currently used mainly for the purchase of firm surplus power. The interconnections with the United States are not primarily used for this purpose, (see section on electricity exports).

The Trans Canada Grid

- The establishment of a national power grid for Canada was extensively investigated by a Federal/Provincial Ministerial Committee on Long Distance Transmission in the mid-1960's, at a time when the Saskatchewan Power Corporation, Manitoba Hydro and Ontario Hydro's West system were electrically isolated from the remaining Canadian systems and from United States utilities, and no substantial power transfer capability existed between Quebec and the Maritimes.

- The Committee reported its conclusions in July 1967, namely that a national grid, or further studies thereon, was not warranted, but that reinforcement of regional interconnections could be expected to be beneficial. Power developments and interconnections since that time indicate that the 1967 conclusions are even more valid today - certainly in the case of Ontario.

- The strengthening of these inter-provincial ties by Ontario Hydro will be continued as long as the resulting benefits justify the costs. This policy is being continued through the use of long-standing liaison committees with adjacent utilities.

D.C. Transmission

- Canada's geography has determined that long distance transmission of electric power is of key interest in the country's energy development. This results from the need to exploit remote sources of hydroelectric energy as well as to maximize the advantages of interconnections between regions. Significant pioneering has taken place on Canadian systems, especially at higher voltages up to the 735 kV level adopted by Hydro Quebec.

- Canada has more operating direct-current (DC) transmission mileage than any other single country in the world and the most recent installation has effectively demonstrated new technology employing thyristor equipment which promises to significantly expand the opportunities for DC systems.

- Initial research is under way in co-operation with other countries on ultra-high voltage (UHV) transmission and voltages above 750kV which may be essential to meet some of Canada's future transmission needs. There are challenges not only in the economics and techniques of transmission, but also the required size of structures tends to make this aspect of the engineering an increasingly difficult part of the task. On the other hand, these higher voltages have the capability of moving much larger quantities of power in a limited physical space.

TABLE 1

ONTARIO HYDRO
EXISTING AND PLANNED 60 HZ INTERCONNECTIONS
115 kV AND ABOVE

Location	Designation Col. 1	Date Established (Note 1) Col. 2	Nominal Voltage kV Col. 3	Nominal Winter Capacity MVA (Note 2) Col. 4
QUEBEC				
Beauharnois	B5A	Oct. 1932	230	400
	B31L	Apr. 1941	230	400
Chenaux	X2Y	July 1942	115	50 (Note 3)
Val Tetreau	V12 M	Nov. 1928	115	200 (Note 3)
Val Tetreau	F10 MV	Nov. 1928	115	200 (Note 3)
Masson	H4AK	July 1933	115	110 (Note 3)
Masson	H9A	Aug. 1940	115	110 (Note 3)
Paugan	P33C	Oct. 1928	230	250 (Note 3)
Paugan	P4C	July 1930	230	250 (Note 3)
Rouyn	K2Z	Dec. 1949	115	30
Rapide des Iles	D3KZ	Oct. 1966	115	40
Holden	1331	Oct. 1966	115	90
MANITOBA				
Kenora	SK1	Oct. 1956	115	60
	K21W	Oct. 1972	230	200
	K22W	Apr. 1973	230	200
NEW YORK				
Niagara	PA27	Dec. 1961	230	480
	BP76	May 1955	230	550
Cornwall	L33P	Dec. 1958	230	360
	New	Future	230	360
MICHIGAN				
Sarnia	B3N	Sep. 1953	230	590
Lambton	L4D	Dec. 1966	345	800
	L51D	Planned 1975	345	800
Windsor	J5D	Sept. 1953	230	570

NOTES: (1) The "date established" is the in-service date of the original interconnection. Changes to some of the interconnections have been made since to increase the voltage and/or the capacity.

(2) The total permissible interchange with the various

TABLE 1 cont.

NOTES: (Cont'd)

(2) (Cont'd)
utilities is not the arithmetic addition of the nominal capacities of the interconnections with that utility.

(3) Capacity of generation normally connected to the tie(s).

Source: Ontario Hydro Submission to Ontario Energy Board Dec. '73

electricity exports

SUMMARY AND CONCLUSIONS

- Interchange transactions with U.S. utilities have provided the domestic market with substantial economic and operational benefits but have not prevented the development of large, self-sufficient Provincial utilities throughout Canada.

- The Ontario Government supports the continued net export of electricity provided that the power is clearly surplus to Canadian requirements.

- Canadian utilities should import power whenever foreign sources are more economic, provided that such imports do not unduly inhibit Canadian development.

- Consideration should be given to Canada exporting power from nuclear plants rather than continuing to export uranium oxide in order to exploit fully the CANDU technology and benefit from the enhanced opportunities for Canadian engineering skills, industrial production and employment.

BACKGROUND DATA

Highlights

. The interconnection of Canadian and U.S. utilities provides many economic and operational benefits to both sides and permits each party to export surplus power. Such as:
- improved frequency regulation
- improved voltage stability
- improved system security
- lower operating reserve
- lower system line losses
- not vulnerable to extreme contingencies
- economy transactions
- seasonal diversity
- co-ordination of maintenance
- capacity of savings.

. All exports of electricity are subject to National Energy Board approval, including a stringent pricing test to avoid export sales being priced below cost and below prevailing market values.

. Electrical exports form only a small proportion of total Canadian production, amounting to about 4% in 1972.

. Ontario Hydro has generally been a net exporter of power to the U.S. in recent years but Ontario's and other Canadian needs are met first.

Export Pricing

. All exports of electricity are subject to approval of the National Energy Board which can grant licenses for agreements of up to 25 years' duration; in practice, most licenses are for periods of 10 years or less.

. Also, all exports must pass a three-point pricing test as follows:

- the prices must more than recover incremental cost,
- the prices must be not less than prices to Canadians for comparable service,
- as far as can be determined, the prices must not be materially less than the alternatives available to buyer.

. Since most Interconnection Agreements provide for mutual aid and assistance, the same terms and prices apply to purchases by Canadian utilities.

Export/Import Transactions

. Exports of electricity form only a small proportion of total production in Canada, amounting to only about 4% in 1972. Since most of the large electrical utilities are owned or controlled by their respective Provincial Governments, the benefits from these sales accrue to the Canadian people.

. Ontario Hydro has assisted U.S. utilities for many years, on an interuptible basis, as indicated in Chart I.

. The following table shows in more detail the Ontario Hydro Export Sales since 1968 and their expected energy exports up to 1975. (under approved amended license)

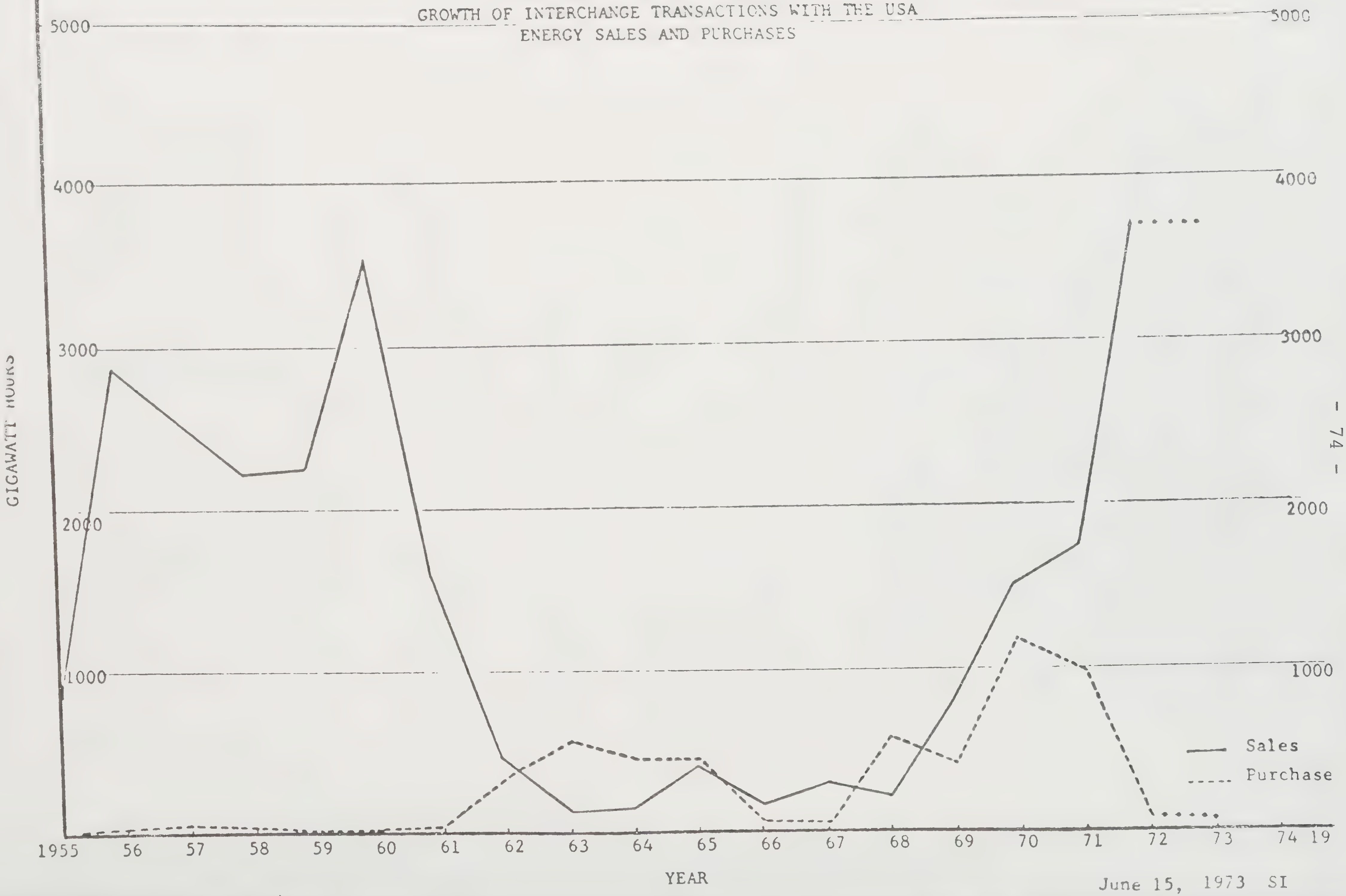
ONTARIO HYDRO EXPORT SALES 1968- 1975

	Net Energy Exports GWh	Gross Revenue $M	Net Revenue $M
1968	1891	1.3	0.3
1969	2190	6.3	2.1
1970	2833	17.6	6.3
1971	3087	22.0	6.4
1972	5254	36.3	16.1
1973 (Est.)	5539	61	31
1974 (F'cast)	6950	n.a.	n.a.
1975 (F'cast)	6950	n.a.	n.a.

. It should be noted that nearly all of Ontario Hydro's exports are based on the use of imported United States coal. It is the policy of Ontario Hydro to impose restrictions on its export sales if the fuel in its generation cannot be adequately replaced.

CHART 1

INTERCONNECTION AGREEMENTS
GROWTH OF INTERCHANGE TRANSACTIONS WITH THE USA
ENERGY SALES AND PURCHASES



June 15, 1973 SI

Source: Ontario Hydro

future energy forms

SUMMARY AND CONCLUSIONS

. In order to satisfy national objectives of self-sufficiency and to make maximum use of limited research capability and funds, the Ontario Government suggests

- a process for establishing national priorities for future energy research associated with a program for financing that research and more comprehensive process of collection and analysis of energy data.
- emphasis in any research program on improvement and consolidation of existing technology, particularly on nuclear technology and environmental protection, rather than research into esoteric energy forms.
- coordination at the national level of all research and development work in the energy field, within a framework of provincial and national science policies.
- joint ventures with other provinces and other countries in research projects of common interest.

BACKGROUND DATA

Highlights

- Current research into future energy forms is proving extremely costly and has, so far, shown limited success in finding applications which could be commercially useful in the foreseeable future.
- As a practical policy, energy planning over at least the next twenty years will have to be based substantially on conventional energy forms with some improvements in existing fuel technology.
- Of the alternatives known to be under serious research study, the most promising for the next decade or so appear to be-
    - further development of the CANDU process
    - gasification or liquefication of coal
    - development of production technology for oil sand deposits.
    - research and development related to the exploitation of Arctic and offshore oil and gas.
- Most of the Federal research expenditures in recent years have been directed toward nuclear energy.

Specific Developments

1. Fossil-Fuels

- Improvement of existing fossil-fuel technology in electricity generation.
    - little scope for more efficient use

- combined-cycle generation offers some benefits
- research and development of sulphur removal process and equipment and its utilization.

Coal Gasification

- current research expected to show commercial results by mid to late-1980's
- problem is to produce a high calorific value gas at competitive cost.
- alternative approaches of gasifying at coal source or point of use and relative merits of transportation of coal or gas.
- advantages of conversion to gas - cleaner to burn and easier to transport.

Coal Liquefaction

- several established techniques known for some time.
- government-owned plant operated in South Africa since 1955.
- could become economic at $6 per barrel for competing oils.
- need to monitor research, particularly in the U.S.A.

Magnetohydrodynamics (M.H.D.)

- research in UK and France has been stopped; in U.S.A. almost no further work planned.
- Russia is only country known to be continuing research.

- process has not shown much promise for practical application, mainly due to combusion and metallurgical difficulties.
- cost of research proved to be extremely high
- is unlikely to be a practical alternative this century.

Oil Sands (Athabasca)

- first recovery plant in 1968
- further research required into mining techniques, oil recovery process, and upgrading process.
- mining of sands below 250 ft. impose severe technical problems.
- use of nuclear energy for recovery at extreme depth has been discarded for technical and other reasons
- significant volumes of oil can be recovered for prices between $5 and $8 per barrel.

Arctic and Offshore Oil and Gas

- little information on potential to date
- concern for social, ecological and environmental impacts.
- research required into adaption of conventional exploration, drilling and transportation methods.

2. Nuclear

. Improvement of CANDU technology

- considered to be potentially most promising route.
- associated development of larger generator sizes.
- possible use of Plutonium or Thorium cycle in 1990's
- organic-cooling research work at Whiteshell has been dropped.
- boiling water also considered as variation to lower capital cost but not showing promise to date.
- energy storage of the steam output being studied to overcome the load-following difficulties of high capacity-factor operation.

Fast-breeder reactors

- more efficient than conventional reactor
- little research in Canada.
- extensive development in U.S., Russia, U.K., France, West Germany and Japan.
- extremely expensive and depends on Government funding
- encountered serious technological problems and U.S. program probably behind schedule. U.K. 250 MW reactor at Dounreay has not operated yet. Latest French 250 MW reactor at Phoenix scheduled for operation very soon.

- U.S. aiming for successful demonstration breeder by 1980 and $500 million plant now being built at Oak Ridge, Tennessee.
- more likely to be pursued than M.H.D. for future electricity generation, particularly in countries where other alternatives are not available.
- of greater concern environmentally than CANDU.

Hydrogen fusion

- still in laboratory stage, surveys indicating 200 experiments in 14 countries.
- breakthrough not expected for at least 5 years and even then, enormous engineering problems to overcome.
- not considered to be an alternative this century

3. Other Energy Forms

Solar Energy

- one demonstration unit in France
- some small-scale laboratory work in the U.S. particularly concerned with practical collection and storage problems.
- requires large area and storage capability - estimated that one square mile of solar farm could supply power for a city of 60,000.
- large scale application very unlikely this century.

- satellite-based cells being seriously considered as longer term development.

Fuel Cells

- spin-off from space program using hydrocarbon source
- further work done by American Gas Association
- no commercial application in foreseeable future

Tidal Power

- feasibility studies at Bay of Fundy not progressed to practical application.
- no potential in Ontario and little potential in Canada other than Bay of Fundy.
- some working schemes in Europe but at high cost

Wind Power

- considerable research done on electricity generation from wind.
- potential for Canada considered low
- unreliable source of power

Geothermal Power

- uses natural steam from the earth
- could be the "largest practical new energy source" (Rex, University of California)
- small commercial fields in Italy (since 1913) and U.S. (near San Francisco)

- very little potential in Canada and none in Ontario.

Power from Garbage

- process proven in demonstration models
- pilot plant to be installed at Lakeview G.S. to supplement coal.
- not significant in total power requirements

Research Expenditures

. At the federal level, research and development effort relating to energy has concentrated on nuclear technology. The following table shows the estimated share of Federal Research Expenditures in 1972-73.

Federal Research Expenditures 1972-73

	% share
Nuclear energy	70.6
Coal	13.4
Oil and gas	10.6
Electrical energy	4.2
Oil sands	0.1
Other	0.1

regulatory mechanisms and jurisdictional issues

INTRODUCTION

This paper discusses regulatory mechanisms in Canada in the energy field from three aspects:

- why existing regulatory mechanisms are what they are;
- why existing regulatory mechanisms are becoming defective and out-of-date;
- recommendations and policy alternatives for the future.

REASONS FOR THE DEVELOPMENT OF EXISTING REGULATORY MECHANISMS

Three principal causes have been responsible for the evolution of existing regulatory mechanisms. These are the fact that the allocation of regulatory power and responsibility, as between the provinces and the federal government, has of necessity followed the allocation of legislative power under the British North America Act, 1867. The legislative and regulatory powers coming into play in the field of energy are mainly powers that have been allocated exclusively - in water-tight compartments as it were - to one jurisdiction or the other. Concurrent powers, such as relate to agriculture, are not involved.

The second main influencing factor is the geographic dispersion of energy resource ownership, that is to say that the provinces which are rich in energy sources do not constitute the consumption or market area, thus necessitating interprovincial transportation and delivery arrangements by means of physical works and undertakings connecting the provinces or interprovincial trade arrangements, under the jurisdiction of the federal government in each case.

The third main influencing factor is the historic degree of governmental involvement in energy planning and policy. Historically, the initiative for the development of an energy source and a market therefor (except for electric power) has largely come from the private sector, the individual entrepreneur. In this, governments in Canada at all levels have traditionally been regulators, or in the case of the provinces, owners receiving royalties, but not, at least until recently, entrepreneurs. The degree or closeness of regulation has varied. In the energy field usually the regulation has not been of a continuous or blanket nature but rather has developed by way of response in

particular cases to particular requests to construct facilities, to set rates, and the like. Traditionally, the governments of the producing provinces were primarily concerned that the energy resource removed from the province was surplus to the long-term domestic requirements of the province and until recently were not directly concerned with exploiting the resource as to price.

The result has been to disperse the exclusive legislative and regulatory jurisdictions attaching to the various stages of the process of the production and consumption of energy among the provinces and the federal government. On the one hand we have the provincial ownership of natural resources and provincial control over intra-provincial trade in energy - transactions having their beginning and their end in the province whether at the wholesale or retail level as well as control over the production of oil and gas, the conservation of natural resources and provincial exploitation of the resource with maximum benefit to the producers. At the consuming stage de facto provincial control exists over the local distribution of energy by public utilities, i.e. natural gas and electric power,and in the case of fuel oil through the provincial power to protect consumers and its power to regulate traffic on the highways. On the other hand there is federal control over interprovincial and export trade and over the regulation of interprovincial undertakings such as interprovincial pipelines.

Historically in the absence of any assertion of federal control over the allocation and pricing of energy due to "an emergency" the federal government controlled the interprovincial movement of oil and gas and imposed rate regulation insofar as transportation costs were concerned, but did not attempt to fix well-head prices at the producing end, and scrupulously

abstained from interference with provincial control over local distribution of oil and gas once delivered to the province of ultimate consumption.

To date, in the consuming provinces the natural monopoly characteristics of the gas business were responsible for rates regulation but there is no rates regulation at the retail level for heating oil and motor gasoline.

THE DEFECTS OF EXISTING REGULATORY MECHANISMS

While plentiful supplies of low-cost energy existed, energy policy was not a prime source of policy concern and the provision of energy, except for electric power, was largely left to the private sector which translated energy policy planning into the necessary business of supplying a market, with subsequent governmental action only when specific regulatory action was required.

The dispersion of exclusive regulatory and legislative jurisdiction had the result that the federal government tended to treat the energy-poor provinces as parties to a public hearing or other proceedings with a right to be heard, in the making of a decision that was exclusively federal rather than as participants in a joint decision affecting both. The energy-poor provinces appeared before federal tribunals such as the National Energy Board (this was also the case before the Canadian Transport Commission or the old Board of Transport Commissioners) because this was the only avenue by which to make their views known, and because they were dependent upon federal action for this supply of energy as it was not indigenous. On the other hand the federal government has not had to appear before provincial tribunals and make its views known in that way.

The present concern with energy pricing and supply raises the necessity for some form of joint federal-provincial policy determination. The days of relative provincial and federal laissez-faire, "leave it to the industry but regulate them" as it were, are finished. It is necessary to avoid destructive and pre-emptive competition among governments seeking to make energy policy by the unilateral exercise of their

own powers - with all of the uncertainties that such competition too often generates. The absence of federal-provincial mechanisms for the joint formulation, implementation and review of national energy policies has forced the consuming provinces to rely on being heard in the course of hearings before the National Energy Board. The Government of Ontario has consistently taken the position that such bodies that proceed through public hearings, frequently adversative in result if not by design, are not the proper vehicles for the expression of provincial policies or for the involvement and consultation with the provinces in the co-ordination of federal and provincial policies or the development of national energy policies. Such forums do not afford the provinces any role in the initial planning of new energy policies, providing only opportunities, by way of response and reaction, to express the provincial views with respect to an existing policy. This has nothing to do with the participation and the development of new policies. Because this quasi-judicial procedure was available and did at least provide a public forum for the expression of policy statements, the Government of Ontario, of late at least, has had a policy of appearing and being heard in proceedings of the National Energy Board (and the Canadian Transport Commission). However, this opportunity to be heard is essentially an opportunity to make an ad hoc response to a narrow regulatory issue, the real policy planning and decision making having originated in the private sector or with the federal government.

The recent policy initiatives by the producing provinces to increase producer prices, as well as royalties, and particular measures to obtain world level prices for their producers rather than for the exporter

at the border - and to refuse permission for the removal of resources from the province except upon satisfactory terms as to price - have raised a number of new issues which have not previously been determined by the courts.

Alberta has enacted the Petroleum Marketing Act to market oil coming to the Crown by way of a royalty, taken in kind, and constituted the Alberta Petroleum Marketing Commission as a mandatory sales agent for the remainder of the oil to which the province's royalty interest does not attach and through which provincial producers must conduct their inter-provincial sales of oil. By an amendment to the Gas Resources Preservation Act which regulates the removal of gas from the province, Alberta has attempted to assimilate and combine whatever rights it might have as the original owner of the gas with the exercise of its legislative jurisdiction, in each case hoping to fix prices in the current of inter-provincial trade.

Saskatchewan, by the Oil and Gas Development and Stabilization Act, 1973, has had the same objective but used different means, namely an export tax combined with a royalty surcharge and with the device of transferring the interests of the holders (lessors) of oil and gas leases to the province subject to compensation.

It seems that the intent of these Acts was to frustrate the federal Oil Export Charge Act by forcing the federal government to reduce the excise tax on exported oil. In addition to being suspect as legislation in relation to trade and commerce, the Saskatchewan legislation is probably an invalid, indirect provincial tax or an invalid provincial levy on goods leaving the province. The producing provinces, resting their position on the legal incidents attaching to the right to ownership

of the resource, and, basing themselves upon the provincial power to manage a resource for purposes of conservation, are purporting to set market quotas with the earmarks of an inter-provincial marketing scheme.

Another issue is whether the provincial power to conserve a resource extends merely to the prevention of physical waste of the resource and does not extend to preventing economic waste (setting prices) for the resource in the current of inter-provincial trade. Involved in the maintenance of prices is the setting of market quotas or the allocation of the market among the producers so as to spread the benefit of that market among them. To the extent the product is involved in inter-provincial trade, this type of provincial action would have to rest on the provincial power to conserve a resource. Indeed if the matters were tested, a court may well hold that the very process of refusing to permit the removal of that much of a resource needed for future provincial requirements is an invalid attempt by the province to legislate in regard to trade and commerce or inoperative as conflicting with paramount federal marketing legislation, if later enacted.

In addition, the policy initiative to increase prices of oil and gas for export has prompted both Alberta and Saskatchewan to legislate to fix the maximum price for domestically consumed oil and gas, providing in effect for a two-price system. Provincial action fixing prices for oil and gas produced and consumed within a province is not open to attack, but the higher export price may well be open to attack on the grounds that it is an indirect tax or an invalid levy on a product leaving the Province and beyond provincial competence in either case.

POLICY ALTERNATIVES

The financial implications for Ontario stemming from the attempt in the past of the producing provinces to intercept and divert the revenues now being received by the federal government under the Oil Export Charge Act are obvious: Moreover, it is necessary to find a device for controlling the upward surge of Canadian oil and gas prices and to ensure the equitable distribution of resource revenues. The creation of a federal marketing scheme for oil and gas, perhaps taking the form of enabling legislation setting up a National Marketing Board of a National Petroleum Corporation would - depending on its terms pre-empt the new provincial legislation, particularly the Alberta Petroleum Marketing Act, Bill 95, the Alberta Arbitrations Amendment Act, 1973, Bill 53, and the Saskatchewan Oil and Gas Conservation, Stabilization and Development Act, 1973, Bill 42. This pre-emptive effect would obtain even if such provincial legislation were competent so long as the new federal legislation were competent.

The Federal Energy Supplies Emergency Act (in force on January 15th, 1974) does not purport to apply to wholesale prices charged by producers at the well-head. Nor does it clearly apply to a provincial government as a wholesale supplier or vendor, although it clearly applies to such a government as a wholesale customer.

NATIONAL MARKETING BOARD - POLICY ALTERNATIVES

- a buyer and seller of crude oil or merely a regulatory body?
- with jurisdiction over oil for export consumption and/or domestic consumption, and if the latter, with power to set a uniform domestic price for crude oil?
- if empowered to set prices for domestic crude oil, at what level, the producer price at the well-head as well as the purchase price by refiners?
- would the price setting powers include wholesale prices from refiners to distributors of refined products, including motor gasoline?
- power to set production quotas for crude oil for domestic use and/or for export?

NATIONAL PETROLEUM CORPORATION - POLICY ALTERNATIVES

The concept of a corporation suggests an operative body, rather than a regulatory body, with the following alternative functions:

- purchasing offshore crude, or products refined offshore from foreign crude, either from the oil companies or directly from the producing states;
- research and development in exploration and production and/or conservation;
- prospecting for frontier or offshore oil and gas directly as does Panarctic Oils, or as an investment vehicle like the Canada Development Corporation, for example.

Although the National Petroleum Corporation would have to be created by federal law, it should be regarded as a national undertaking with appropriate opportunities for Canadians to participate in the management and policies thereof by private or provincial investment. The details of the most appropriate private and provincial involvement would have to be worked out jointly by the federal and provincial governments.

JOINT POLICY ADMINISTRATION AND APPLICATION

The direct involvement of provincial representatives in the proceedings of the existing regulatory bodies in the energy field is desirable, although these regulatory bodies should continue under federal legislation. The desirability of direct provincial involvement outweighs the risk that this would introduce partisan interests into the quasi-judicial operations of these agencies. The potential for disrupting the ability of these agencies to deal fairly with parties before them that might be caused by such direct provincial involvement, can be avoided or minimized by appropriate structuring of their proceedings.

These principles should govern the establishment of any National Marketing Board and its operation. The direct involvement of provincial representatives on the Energy Supplies Allocation Board is also desirable.

THE MODEL OF THE MINES MINISTERS

The Mines Ministers have evolved a continuing forum for consultation and discussion which is currently developing a mineral policy for Canada. This serves as a useful model for a mechanism in the energy sphere.

- The federal and provincial mines ministers established the Canadian Ministerial Conference on Mineral Policy at their meeting on November 23, 1973.
- The membership of the body is flexible. Government can designate whatever ministers it deems appropriate to attend according to the agenda items under discussion.
- A supporting committee of Deputy Ministers of Mines offers recommendations and advice to the Ministers, and undertakes special assignments from the Ministers.
- The meetings are annually or more often as required. The annual meeting will follow the follow-up meeting of the Provincial Mines Ministers Conference where possible.
- Chairmanship is held jointly by the Federal Minister of Energy, Mines and Resources and the Provincial Minister hosting the annual Provincial Mines Ministers Conference.
- The Canadian Intergovernmental Conference Secretariat will undertake the meeting arrangements and preparation of the agenda in consultation with the co-chairmen.
- The following definition on consultation agreed to by the Mines Ministers may be a useful reference in the deliberation on a mechanism for energy policy formulation.

- "Intergovernmental consultation in the field of mineral policy means intergovernmental dialogue that takes place early enough in the policy-making process so that the federal and provincial governments have the opportunity to influence each other's views. Intergovernmental consultation does not necessarily imply agreement."

economic factors

SUMMARY

- The economic outlook for Ontario has weakened as a result of the existing energy situation. Even with the assumptions of very limited oil price increases and no severe shortages, the growth rate in real GPP will be 4 - 5 per cent in real terms compared to an original forecast of about 6 per cent. Inflation pressure will be very strong as the Consumers Price Index could rise by as much as 10 per cent.

- Economic performance will decline in relation to oil price increases. For example, preliminary analysis indicates that a sudden oil price increase to $10 per barrel would cut real GPP growth in Ontario by 3 per cent, resulting in a loss of 70,000 jobs.

- The longer-term impact of the energy situation centres on the economic stresses produced by the drive for national energy self-sufficiency and the resulting implications for fiscal, monetary and manpower policies.

- Canadian energy policies should unfold within a co-ordinated, strategic economic and fiscal plan. Otherwise severe pressures and dislocations in capital and labour markets will develop.

- The final section of the paper provides data and preliminary analysis on energy inputs to Ontario manufacturing industries.

THE ENERGY SITUATION AND ONTARIO'S ECONOMIC OUTLOOK, 1974

"Pre-Energy"

Previous to the dramatic oil price increases, the economic outlook for Canada and Ontario in 1974 was for a slightly slower and more balanced growth pattern. High-lights of the "pre-energy" forecast were:-

- GNP and GPP were projected to grow at between 5.5-6.0 per cent in real terms, with Ontario's growth slightly higher than the national rate;
- Unemployment was expected to decline slightly, from 5.6 to 5.4 per cent in Canada, and 4.1 to 3.8 per cent in Ontario;
- Inflation was expected to continue at a relatively high rate, i.e. in the area of 6 per cent; and
- A strong expansion in business investment spending was projected.

"Post Energy"

The following points summarize the most optimistic outlook for Ontario, given the highly uncertain situation. It is based on the assumption of very limited oil price increases and no severe distribution problems.

- GPP would grow at 4-5 per cent in real terms;
- Unemployment would remain at about the 1973 level (4 per cent average);
- Inflation pressure will be stronger with the Consumer Price Index possibly rising at a rate of 8-10 per cent; and
- The outlook for business investment expansion is still strong but could be weakened by delays in obtaining supplies.

Impact of the Energy Situation

The current energy situation obviously creates rather large uncertainties for the 1974 economic performance. Indeed, the full dimensions of the oil situation itself, let alone its general economic impact, remain unknown. For example:-

- The spot price of Middle East oil has risen to over $11 per barrel (with Venezuelan oil at about $14 per barrel) and could still go higher. While Middle East producers have apparently agreed to a 3-month 'freeze' their behaviour is by no means predictable.

- Middle East shipments are embargoed to the United States yet rumours abound concerning "leakage" into the United States. Texaco, the first American oil company to publish inventory figures, show a 40 per cent increase in inventories over January 1, 197

- Although the oil embargo does not apply to Canada, there is a great deal of uncertainty with respect to Middle East shipments.

- Federal, Alberta and Saskatchewan policies for oil prices and export taxes have not been co-ordinated or settled. The outcome will determine the price of western oil and possible subsidy arrangements for the East.

- Western natural gas prices could follow up oil price increases. Prices to some U.S. buyers have already been increased.

- Both the Ontario and federal governments have urged people to conserve energy on a voluntary basis, but actual response is not yet known.

Gasoline and heating oil prices did escalate significantl in 1973 and are probably in for further increases. However, prices have risen in every part of the country suggesting that a good part of the increases to date were not induced by the Middle East situation.

SELECTED HOME HEATING OIL PRICES

	Price Per Gallon 1972	Jan.1,1974	Per Cent Increase
	(¢)	(¢)	(%)
Halifax	24.7	33.2	34.4
Montreal	22.9	33.4	45.9
Toronto	22.9	27.3	19.2
Thunder Bay	24.2	28.6	18.2
Winnipeg	20.2	24.6	21.8
Regina	20.0	24.4	22.0
Edmonton	19.2	23.6	22.9
Vancouver	21.8	26.2	22.9

Note: See Appendix A for more complete details and for gasoline price changes.

In Ontario, the supply question is dominated by the Province's reliance on eastern refineries. While Ontario receives all of its crude oil from Western Canada, refinery capacity has not been expanded in about four years. Thus, eastern (Montreal) refineries provide Ontario with 14 per cent of its motor gasoline, 25 per cent of its light fuel oil and 38 per cent of its heavy fuel oil. The basic supply outlook for Ontario is not known with any degree of certainty. The Technical Advisory Committee of the National Energy Board states that the overall supply and demand situation for oil products in Ontario this winter will be in "precarious balance".

The price of petroleum products in Ontario will depend on:-

- the price of western oil, presumably to be determined by federal-provincial negotiation; and

- the price of eastern oil which will depend on further Middle East actions and possibly subsidy arrangements involving transfers through the federal government to provincial governments, oil producers and suppliers, and/or consumers.

In 1974, Ontario consumption of oil is projected at slightly over 200 million barrels of oil. Thus, every additonal dollar of cost to Ontario would create additional costs of about $200 million.

Aggregate Economic Impact of Possible Oil Price Increases

Following is a brief analysis of the aggregate economic impact of an increase in oil prices in Ontario. It should be noted that the analysis is preliminary in nature, and simply focusses on one main variable--a change in the price of oil entering Ontario. Assumptions include:-

- estimated 4.5 per cent growth rate in oil consumption regardless of price increases. (Ontario Energy Board estimates 1972 consumption at 188.7 million barrels of petroleum products, with 1974 consumption at 206 million barrels.)

- Additional costs flow out of Ontario to other governments.

- 85 per cent of price increases are ultimately borne by Ontario consumers, and 15 per cent of costs are exported. No allowance is made for the marking-up of costs as goods flow through intermediate production levels.

The basic analysis, summarized in the table, indicates that for each $1.00 of price increase, Real Gross Provincial Product in Ontario would decline by 0.5 per cent. If the price were to rise suddenly to the existing international level, say $10, then the loss in Real GPP in Ontario would be about 3.0 per cent and the number of jobs lost would be about 70,000 with a resulting unemployment rate of 5.6 per cent.

ESTIMATED LOSS IN ONTARIO REAL GPP PER $ INCREASE IN OIL PRICES*

	Price Increase per barrel			
	$1.00	$2.00	$5.00	$6.00
Initial Effects ($ million)				
Income transfer out of Ontario	-206	-412	-1,030	-1,236
Total consumption change (1961 $)**	-109	-218	-545	-654
Multiplier Effects included				
GPP change (1961 $)	-164	-327	-820	-984
Change as per cent of Real 1974 GPP	-.5	-1.0	-2.5	-3.0

* This analysis is based on the Policy Planning Branch simulation model, ONFORM, which is designed to simulate and analyze various changes in economic conditions in Ontario and Canada.

** Disposable income is assumed to decline and as a result both consumption and saving are reduced.

The above estimates provide only a first approximation and obviously a great many factors will determine the level of Real GPP in 1974. For example, if potential natural gas price increases and federal sales tax effects are taken into account, the negative impact of oil price increases on the Ontario economy could be greater. Alternatively, subsidy arrangements could partially alleviate the impact of higher prices.

Ontario Economic Outlook-1974

In light of the above considerations, the economic outlook cannot be described with any degree of certainty. However, the following points provide a rough sketch of a 1974 forecast. It is optimistic, in that it assumes relatively minimal oil price increases and no severe shortages.

- Assuming that Ontario industries pay lower prices for energy inputs than their American competitors, 1974 could be a relatively good year for Ontario producers in that they may increase their share of the domestic market because of higher import prices, and increase their foreign market share where effective demand still exists, but production is curtailed because of energy shortages.

- Inflation will dominate the economic outlook both on the international level and in Canada. The Consumer Price Index could rise by as much as 10 per cent in 1974.

- Consumption Expenditures should increase at a rate slightly less than 1973 levels, probably in the neighbourhood of 10-12 per cent. Levels of housing construction and automobile sales will likely not improve, with a resulting weakening in durable goods spending. Non-durable goods and services will likely rise by around 10-12 per cent. The growth in retail sales will decline, with the increase in the area of 11 per cent.

- Business investment intentions are still high despite the energy situation. No significant cut in the original high level of investment plans is foreseen. However, problems could be encountered on the supply side with the continuation of materials and skilled labour shortages. Generally, Ontario business investment is projected to increase at about 15 per cent.

- Residential construction will also suffer from materials and labour shortages. Alternatively, the Ontario Housing Action program should help to maintain a reasonable pace of housing construction, with dollar outlays up by 8-9 per cent.

- No further significant improvement in the employment situation can be foreseen, and possibly. there will be some slippage from the low level achieved in 1973.

- Overall growth is, of course, highly dependent on the energy situation. The current projection remains optimistic with GPP rising at 10-12 per cent, with a 4-5 per cent real increase. This is contingent on minimal disturbances resulting from the energy situation.

THE ECONOMIC DEVELOPMENT ASPECTS OF THE ENERGY PROBLEM

1. Introduction

A likely scenario of the energy situation for the remainder of the 1970's would be one not much different from the current situation or from that which has occurred in the past:

- It is likely that friction will continue between OPEC and the consuming countries.
- Increases in the price of crude oil as well as temporary interruptions of supply could, therefore, be a frequent occurrence.

Under these circumstances, the optimum strategy for Canada in the medium- and long-term will be the development of potential self-sufficiency in oil production and distribution.

Energy problems cannot be solved in isolation from larger economic problems of industrial development and public sector financing and fiscal policies. For example, a policy of oil self-sufficiency would require the completion of a number of highly capital intensive projects within the next few years. Unfortunately, the magnitude of these projects is such that if they are acted upon in an unplanned way, they could very easily affect the attainment of other national and regional economic priorities and objectives.

2. Energy Financing Requirements

Capital requirements for an average rate of development of Canada's energy resources for the 1970's have been estimated at approximately $45 billion.

This estimation includes:

1. The continuation of the present rate of conventional oil and gas exploration, development, processing, and distribution.

2. The construction of two tar sands plants of 100,000 - 125,000 bbls/day capacity each.

3. The forecasted investment expenditures for Ontario Hydro, Quebec Hydro, and other provincial power projects. (Capital construction expenditures for Ontario Hydro alone between 1974 and 1980 will be $9 billion.)

If the Mackenzie Valley gas pipeline is constructed, and the tar sands undergo a greater intensity of development, the capital requirements to 1980 would jump to between $50 billion - $55 billion.

If Canada is to meet its future energy requirements, it becomes very important that an appropriate investment climate prevail in order that these projects may be financed. This will require sensitive management of fiscal and monetary policy. Most importantly, it will require the initiation of public sector programs and policies directed towards restraining the strong inflation to be expected from unbalanced development. Rapid price changes, of course, can have a devastating effect on the long term bond market.

3. The Economic Implications of Large Energy Developments

If construction begins on the Mackenzie Valley gas pipeline and/or more intense development proceeds on the Athabasca tar sands, the large capital requirements required could have serious economic repercussions unless there is careful planning on the part of governments and the private sector.

Studies within the Ontario Government indicate that if in addition to the average rate of energy developments, construction begins on one large energy project such as the Mackenzie Valley gas pipeline, the "costs" of the project in terms of pressures on prices, interest rates, and the exchange rate, do not appear to be too excessive as long as sensible fiscal and monetary policies are followed. But, there are two major areas in which problems could arise. If not satisfactorily resolved, they could have serious implications for prices and interest rates and the balanced development of the economy. These two areas are labour markets and the capital market.

(a) The Implications for the Labour Market

Considering the actual construction projects scheduled over the next few years and the potential projects that could be added to this investment stream, the manpower supply for certain key skills will be critical.

The supply characteristic of skilled construction labour is such that attempts to draw large numbers of men into this sector will give rise to rapidly escalating costs.

At the same time, there are large indirect and induced employment effects generated by such projects. Labour markets could as a result become very tight in the latter part of the 1970's, with labour shortages in some skill areas. This would create bottlenecks which would retard development not only in the energy sector but in other sectors as well.

(b) <u>The Implications for the Capital Market</u>

The Canadian financial system is sophisticated enough and will be large enough at the time financing will be required, to handle the financing of a large proportion of the $5 billion required for the pipeline. However, in a drive for self-sufficiency, much more than this additional $5 billion will be required. Additional investment will be required by firms servicing the pipeline and the various support industries. For example, indications are that railways will have to purchase additional railway cars to move supplies, trucking companies will have to purchase additional vehicles, airlines and airline facilities that currently

supply the area will very likely have to expand, and so on. Furthermore, the increase in economic activity and the resulting increase in incomes will mean increases in investment in industries connected with personal consumption.

There will, of course, be an increase in domestic saving generated by the rise in economic activity. However, internal studies by TEIGA indicate that the rise in savings would fall short of the increase in investment requirements. The shortfall would have to be made up by an increase in the use of foreign savings in the form of net inflows of long-term debt and equity, or by adjustments to fiscal policy to discourage consumption and promote savings.

Over the remainder of the 1970's, the following sectors can be expected to take a higher proportion of available savings of Canadians than has been the case in the past--housing, transportation, (especially urban transportation), urban redevelopment, anti-pollution programs. A diversion of Canadian savings into an energy project such as a Mackenzie Valley gas pipeline could mean that spending in the above programs will be reduced.

4. The Policy Implications

Because of capital market and labour market constraints and the serious consequences on the economy, Canada may not be able to undertake both the construction of the Mackenzie Valley gas pipeline and a more intense development of the tar sands, simultaneously. With very careful fiscal and monetary policy planning, these large projects could likely proceed, but without suitable government policies and programs, serious economic dislocation will no doubt occur. At the same time, it will be difficult to expect domestic financial institutions to finance energy projects and to put a higher proportion of their investible funds into mortgages and provincial-municipal bonds. This emphasizes the need to monitor the timing of major investment expenditure so as to avoid placing undue strain on capital and labour markets, and to devise a method for coordinating development plans to ensure that financing is spread evenly over the decade. It is possible that a national system of capital expenditure priorities will be required.

ENERGY AND
ONTARIO MANUFACTURING

In projecting the economic impact of the oil situation, a major consideration is the potential impact on particular industrial sectors and the resulting effects on employment, output and prices. Although the full dimensions and facts of the energy situation are not yet known, and data relate to earlier years, some preliminary analysis is available. It pinpoints the industries which are high energy users and which thus could be most directly affected by shortages and price increases. Two qualifications should be kept in mind:

- extensive quantitative data is only available for 1971 and thus does not reflect subsequent energy cost increases; and
- figures only reflect direct energy requirements.

Major Industrial Energy Users (1971)

Following is a summary of the data presented in the accompanying tables. Overall, fuel and electricity costs accounted for less than $20 per $1000 value of shipments. The industries which rely most heavily on energy inputs are:

- non-metallic mineral products;
- paper and allied products;
- primary metals; and
- chemical and chemical products.

Together, these industries accounted for 25 per cent of 1971 industrial output in Ontario.

The data also show Ontario industry's direct reliance on petroleum-based fuels:

> <u>Fuel Oil</u>: Three industries--non-metallic mineral products, paper, and primary metals--are the heavy users. Each consumed over $5 worth of fuel oil for each $1,000 worth of shipments. Within the first category, lime and cement manufacturing are the heaviest users, at $80 and $40, respectively, for each $1,000 of output.
>
> <u>Gasoline</u>: Greatest dependence on gasoline is found in the wood, food and beverage, and non-metallic mineral products industries.

<u>Employment</u>

Overall, Ontario industries consumed about $600 of fuel and electricity per worker. Especially heavy requirements per employee existed in the following areas:

- petroleum and coal products (about $3,000 per employee);
- non-mineral metallic products ($1,700);
- chemical products ($1,500); and
- primary metals ($1,400).

These industries accounted for total employment of 137,000 people, 4 per cent of the Provincial work force in 1971. The very heavy fuel oil users on a per employee basis are cement and lime manufacturing firms, as well as the miscellaneous petroleum and coal products industry, all with over $1,000 worth of fuel oil per employee in 1971. Total Provincial employment in those areas was, however, only 1,500 people in 1971. The very heavy gasoline users include the dairy products industry, the feed industry,

the ready-mix cement industry and the miscellaneous petroleum and coal products industry. Total 1971 employment in this group was 16,000.

INDUSTRY OUTPUT AND DIRECT ENERGY REQUIREMENTS OF ONTARIO INDUSTRIES - 1971

Industry	Value of Shipments of own Manufacture ($000's)	Dollars Spent on Energy Per Thousand Dollars of Shipments*				
		Total Fuel and Electricity ($ per $1000)	Fuel Oil ($ per $1000)	Gasoline ($ per $1000)	Natural Gas ($ per $1000)	Electricity ($ per $1000)
Food & Beverage Ind.	3,693,710	12.02	2.48	2.98	2.48	3.59
Tobacco Products Ind.	324,203	3.60	.82	.35	.37	2.02
Rubber Ind.	801,425	14.56	3.36	.48	2.06	8.23
Leather Ind.	205,218	9.25	2.77	.32	1.68	4.10
Textile Ind.	751,868	14.35	2.83	.35	3.12	7.48
Knitting Ind.	113,969	10.78	2.41	.22	2.98	4.45
Clothing Ind.	319,167	3.07	.37	.23	.52	1.77
Wood Ind.	360,390	18.79	3.82	5.10	2.05	7.21
Furniture & Fixture Ind.	381,739	9.20	1.19	1.05	2.05	4.37
Paper & Allied Ind.	1,377.560	46.74	6.51	.54	12.23	23.03
Printing, Publishing & Allied Ind.	848,131	6.37	.62	.89	.89	3.47
Primary Metal Ind.	2,357,390	41.98	6.84	.29	10.00	17.67
Metal Fabricating Ind.	2,152,600	10.69	1.02	1.12	3.42	4.85
Machinery Ind.	1,398,620	7.18	.75	.43	2.12	3.60
Transportation Equipment Ind.	5,567,950	6.47	.66	.31	1.38	3.27
Electrical Products Ind.	1,910,990	7.30	.96	.36	1.66	4.22
Non-Metallic Mineral Products Ind.	774,115	56.28	10.48	3.44	20.24	17.54
Petroleum and Coal Products Ind.	701,045	12.50	.37	.13	2.31	9.66
Chemical and Chemical Products Ind.	1,630,720	38.34	3.30	.73	10.09	17.09
Miscellaneous Manufacturing Ind.	754,597	9.04	1.35	1.16	1.62	4.25
Total - All Industries	26,225,400	17.33	2.52	1.01	4.30	7.67

Source: Ontario Statistical Centre (Annual Census of Manufactures).

* Steam and other miscellaneous fuels have not been listed separately. Therefore the components will not sum to the total.

EMPLOYMENT AND DIRECT ENERGY REQUIREMENTS OF ONTARIO INDUSTRIES - 1971

Industry	Total Employment	Dollars Spent on Energy Per Person Employed*				
		Total Fuel and Electricity ($)	Fuel Oil ($)	Gasoline ($)	Natural Gas ($)	Electricity ($)
Food & Beverage Ind.	76,697	578.87	119.27	143.47	119.26	173.08
Tobacco Products Ind.	3,230	361.39	82.61	35.09	37.45	202.28
Rubber Ind.	27,548	423.71	97.88	14.01	59.79	239.42
Leather Ind.	12,657	150.00	44.94	5.18	27.25	66.45
Textile Ind.	28,452	379.26	74.76	9.29	82.37	197.63
Knitting Ind.	7,101	172.96	38.73	3.49	47.79	71.41
Clothing Ind.	22,308	43.93	5.30	3.27	7.45	25.38
Wood Ind.	16,766	403.89	82.09	109.73	44.07	154.91
Furniture & Fixture Ind.	19,957	175.96	22.80	20.03	39.14	83.66
Paper & Allied Ind.	42,760	1,505.79	209.63	17.27	394.03	742.01
Printing, Publishing & Allied Ind.	42,315	126.18	12.37	17.59	17.56	68.68
Primary Metal Ind.	68,863	1,437.13	234.20	9.92	342.25	604.96
Metal Fabricating Ind.	77,958	295.24	28.23	30.80	94.41	133.84
Machinery Ind.	47,331	212.06	22.21	12.66	62.77	106.39
Transportation Equipment Ind.	96,468	359.97	36.66	17.30	76.54	181.76
Electrical Products Ind.	73,731	189.12	24.80	9.30	43.01	109.44
Non-Metallic Mineral Products Ind.	24,904	1,749.36	325.74	107.02	629.07	545.36
Petroleum and Coal Products Ind.	2,889	3,033.24	90.66	32.19	560.82	2,344.68
Chemical and Chemical Products Ind.	40,245	1,553.73	133.53	29.70	408.68	692.35
Miscellaneous Manufacturing Ind.	34,677	196.70	29.34	25.29	35.34	92.49
Total - All Industries	767,357	592.39	86.05	34.58	146.79	262.14

Source: Ontario Statistical Centre (Annual Census of Manufactures).

* Steam and other miscellaneous fuels have not been listed separately. Therefore the components will not sum to the total.

COMPOSITION OF USAGE BY INDUSTRY - ONTARIO 1971

Industry	Total Fuel and Electricity ($000's)	Breakdown of Energy Costs by Type of Fuel (% of Total)*					
		Fuel Oil (%)	Gasoline (%)	Liquid Petroleum Gas (%)	Natural Gas (%)	Coal (%)	Electricity (%)
Food & Beverage Ind.	44,397	20.60	24.78	.84	20.60	2.06	29.90
Tobacco Products Ind.	1,167	22.86	9.71	.59	10.36	.33	55.97
Rubber Ind.	11,672	23.10	3.31	.66	14.11	.53	56.51
Leather Ind.	1,899	29.96	3.45	.18	18.17	3.93	44.30
Textile Ind.	10,791	19.71	2.45	.27	21.72	.83	52.11
Knitting Ind.	1,228	22.39	2.02	.01	27.63	6.04	41.29
Clothing Ind.	980	12.06	7.44	.00	16.96	.18	57.78
Wood Ind.	6,772	20.32	27.17	.95	10.91	1.12	38.35
Furniture & Fixture Ind.	3,512	12.95	11.41	.61	22.25	4.59	47.55
Paper & Allied Ind.	64,388	13.92	1.15	.34	26.17	7.82	49.28
Printing, Pulbishing & Allied Ind.	5,402	9.81	13.94	.15	13.92	.18	54.43
Primary Metal Ind.	98,965	16.30	.69	.20	23.82	16.19	42.10
Metal Fabricating Ind.	23,017	9.56	10.43	.99	31.98	.79	45.33
Machinery Ind.	10,037	10.47	5.97	.90	29.60	2.53	50.17
Transportation Equipment Ind.	34,726	10.18	4.81	.51	21.26	9.64	50.49
Electrical Products Ind.	13,944	13.11	4.92	.42	22.74	.58	57.87
Non-Metallic Mineral Products Ind.	43,566	18.62	6.12	.43	35.96	6.83	31.17
Petroleum and Coal Products Ind.	8,763	2.99	1.06	.02	18.49	.00	77.30
Chemical and Chemical Products Ind.	62,530	8.59	1.91	1.47	26.30	4.87	44.56
Miscellaneous Manufacturing Ind.	6,821	14.92	12.86	.45	17.97	5.73	47.02
Total - All Industries	454,576	14.53	5.84	.59	24.78	7.22	44.25

Source: Ontario Statistical Centre (Annual Census of Manufactures).

* Steam and other miscellaneous fuels have not been listed separately. Therefore the components will not sum to 100.

ENERGY CONSUMPTION BY INDUSTRY AS A PER CENT OF TOTAL MANUFACTURING - ONTARIO 1971

Industry	Proportion of Total Manufacturing Represented by Each Industry					
	Shipments of Own Manufacture (%)	Total Employees (%)	Total Fuel and Electricity (%)	Fuel Oil (%)	Gasoline (%)	Natural Gas (%)
Food & Beverage Ind.	14.08	9.99	9.77	13.85	41.47	12.75
Tobacco Products Ind.	1.24	.42	.26	.40	.43	.18
Rubber Ind.	3.06	3.59	2.57	4.08	1.45	2.32
Leather Ind.	.78	1.65	.42	.86	.25	.12
Textile Ind.	2.87	3.71	2.37	3.22	1.00	.96
Knitting Ind.	.43	.93	.27	.42	.09	.00
Clothing Ind.	1.22	2.91	.22	.18	.27	.00
Wood Ind.	1.37	2.18	1.49	2.08	6.93	1.95
Furniture & Fixture Ind.	1.46	2.60	.77	.69	1.51	.84
Paper & Allied Ind.	5.25	5.57	14.16	13.57	2.78	8.10
Printing, Publishing & Allied Ind.	3.23	5.58	1.19	.80	2.84	.20
Primary Metal Ind.	8.99	8.97	21.77	24.42	2.58	8.80
Metal Fabricating Ind.	8.21	10.16	5.06	3.33	9.05	8.55
Machinery Ind.	5.33	6.17	2.21	1.59	2.26	3.36
Transportation Equipment Ind.	20.47	12.57	7.64	5.36	6.29	8.34
Electrical Products Ind.	7.29	9.61	3.07	2.77	2.59	2.18
Non-Metallic Mineral Products Ind.	2.95	3.25	9.58	12.28	10.05	6.75
Petroleum and Coal Products Ind.	2.67	.38	1.93	.40	.35	.04
Chemical and Chemical Products Ind.	6.22	5.24	13.76	8.14	4.51	33.63
Miscellaneous Manufacturing Ind.	2.88	4.52	1.50	1.54	3.30	.94
Total - All Industries	100.00	100.00	100.00	100.00	100.00	100.00

Source: Ontario Statistical Centre (Annual Census of Manufactures).

PRODUCTION DATA FOR ONTARIO INDUSTRIES - 1971

Industry	Number of Establishments	Value of Shipments of Own Manufacture ($000's)	Gross Value Added ($000's)	Wages and Salaries ($000's)	Total Employees
Food & Beverage Ind.	1,829	3,693,710	2,327,420	551,054	76,697
Tobacco Products Ind.	13	324,203	207,189	23,972	3,230
Rubber Ind.	335	801,425	374,248	199,628	27,548
Leather Ind.	180	205,218	105,680	66,884	12,657
Textile Ind.	382	751,868	413,269	182,366	28,452
Knitting Ind.	96	113,969	58,225	33,747	7,101
Clothing Ind.	458	319,167	149,566	107,515	22,308
Wood Ind.	733	360,390	185,669	104,226	16,766
Furniture & Fixture Ind.	872	381,739	183,620	125,440	19,957
Paper & Allied Ind.	289	1,377,560	770,515	344,515	42,760
Printing, Publishing & Allied Ind.	1,574	848,131	281,425	343,630	42,815
Primary Metal Ind.	204	2,357,390	1,204,120	624,536	68,863
Metal Fabricating Ind.	2,157	2,152,600	1,065,670	613,977	77,958
Machinery Ind.	534	1,398,620	747,238	394,689	47,331
Transportation Equipment Ind.	389	5,367,950	3,644,410	905,590	96,468
Electrical Products Ind.	471	1,910,990	964,290	535,293	73,731
Non-Metallic Mineral Products Ind.	537	774,115	340,449	199,904	24,904
Petroleum and Coal Products Ind.	32	701,045	559,476	33,270	2,889
Chemical and Chemical Products Ind.	574	1,630,720	771,433	337,382	40,245
Miscellaneous Manufacturing Ind.	1,081	754,597	338,187	240,964	34,677
Total - All Ind.	12,740	26,225,400	14,692,100	5,968,580	767,357

Source: Ontario Statistical Centre (Annual Census of Manufactures).